A REVISION OF FICUS, SUBGENUS SYNŒCIA

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When King's monograph of Ficus appeared fifty years ago, there were six species of Synœcia. Eleven others have since been described, one from Formosa, eight from the Philippines and two from Borneo. That from Formosa, *F. terasoensis,* has already been identified with the Philippine *F. megacarpa.* I now find that *F. megacarpa* is a leaf-variety of the widespread *F. callicarpa* and that five more of the Philippine novelties have been misplaced in Synœcia: four belong to Eusyce, and one has already been transferred to Urostigma. Of these eleven, there remain, as proved species, only two from the Philippines, namely *F. Bordenii* and *F. cataupi,* and one from Borneo, *F. tawaensis:* concerning *F. Simiae,* of Borneo, I am uncertain (p. 145).

In 1932 and 1933, the late Mr. C. E. Carr, F.L.S., collected for seven months on Mt. Kinabalu in British North Borneo. At my request he made a special study of wild figs, taking careful field-notes on the colours of the receptacles and preserving material in spirit as well as dried. He collected five species of Synœcia, four of which I describe as new in this paper, namely *F. barba-jovis, F. Carri, F. dens-echini* and *F. tulipifera.* The importance of this magnificent collection was at once evident from my own studies on the Malayan species; and it has led me to revise the subgenus. A fifth new species, *F. grandiflora,* I describe from a collection of Mr. and Mrs. J. Clemens, also from Kinabalu. I am obliged also to make four new varieties of *F. callicarpa.*

When thus pruned and extended, the subgenus contains 13 good species, two doubtful species (*F. Simiae* and *F. singalana*) and four varieties. To the descriptions, themselves, I have added several critical diagnostic characters, particularly of the flowers and leaves, that have been overlooked but without which the affinity of the species cannot be ascertained. Indeed, previous descriptions of the species convey little idea of their decisive character. I have arranged the species in what seems to be their natural order (p. 95), but our knowledge of the subgenus is very imperfect. That the number of species could have been doubled in the last ten years and that all these novelties should have come from one part of British North Borneo

reflect sadly on our ignorance of the flora of large areas of the Malay Archipelago. Because they are big climbers, the species have doubtless escaped the attention of field-botanists, for no other sort of plant is more difficult to collect. The uncertain specificity of *F. callicarpa* and *F. punctata* shows, too, the need of many more collections of these common plants from such countries as Sumatra, Borneo and Celebes, Palawan, Timor, Flores and the Moluccas. There is undoubtedly a variation afoot which suggests the persistent evolution of the species.

In spite of its expansion Synœcia, as understood by King, remains a most natural subgenus. Its area of distribution must also indicate the natural limit of the greater part of the Malaysian flora (p. 91). When the distribution of the species is better known it will provide some critical evidence for the history of the Archipelago.

For the completion of this revision I was permitted to borrow the rich collections in the Herbaria at Buitenzorg, Manila and Calcutta, and I express my thanks to the Directors of these institutions, to Dr. D. F. van Slooten of Buitenzorg, Dr. E. Quisumbing of Manila and to Mr. J. D. Srinivasan of Calcutta, for their unstinted assistance. I have to thank also Mr. C. E. C. Fischer, of Kew Herbarium for kindly examining the type-specimen of *F. Scratchleyana* at the British Museum, and Dr. T. Sata of Taihoku Imperial University, Formosa, for a specimen of *F. terasoensis*.

In the citation of collections under each species only the collections that I have examined are mentioned.

Habit

All the species are root-climbers with tufts of short adventitious roots like ivy plants (Hedera). The main stems develop into stout trunks with greyish white bark: they are adpressed to the trunk of the supporting tree, though old stems may break loose and hang like the descending roots of a Urostigma: they are commonly rather flattened and elliptic in section, even strap-shaped, and may reach 10–15 cm. in their long diameter. It appears that the plants always start from seeds on the ground—no doubt because animals do not eat the fruits: they first develop thin creeping stems that trail over rocks, earth and fallen trunks and branches until they reach a living tree up which they ascend to heights of 50 metres and more.

In manner of branching and dimorphic foliage, the species present two conditions, which I consider important because they indicate the state of evolution of the species. I have used this distinction in the key on p. 95, though it must be admitted there is no information of the condition in several species because such can be learnt only from

living plants. *F. apiocarpa,* which seems the least specialised member of the subgenus, has long branching leafy sprays that loop and trail over the limbs of the support, and there is no other difference than one of size between leaves on its aerial branches and those that creep on the ground. I presume that *F. Bordenii* and *F. Scratchleyana* also have this habit. But in *F. punctata* and *F. callicarpa* the hanging leafy sprays in the upper part of the plant are short and sparingly branched, not entangling the crown of their support, and they bear leaves of a different shape, as well as of a much larger size, from the branches that creep on the ground and over the trunk of the support. One may conveniently use the terms *bathyphyll* and *acrophyll* for these kinds of leaf, in the sense in which they have been employed by Holttum for the climbing ferns Teratophyllum and Lomagramma (2, 3). The leaves which are born on the lower, creeping shoots and are themselves flattened to the trunk or substratum which the stem is creeping over, are the *bathyphylls:* they may be juvenile leaves of young plants or the early formed leaves on side shoots of old stems. The leaves that are born on the free-hanging sprays in the upper part of the plant are the *acrophylls* and they are the normal adult leaves. Transitions between the two kinds of leaf always occur.

I think that all other species of Synœcia, except perhaps *F. dens-echini,* possess bathyphylls and are thus clearly in a higher state of vegetative, or scandent, evolution than *F. apiocarpa,* c.f. species of Willughbeia, Scindapsus, Teratophyllum. The attention of botanists should be drawn to the necessity of collecting both bathyphylls and acrophylls, or of recording the presence or absence of bathyphylls, in living plants because the distinction seems naturally to divide the subgenus into two groups.

In the following descriptions, the word 'leaf', unqualified, indicates the acrophylls, the bathyphylls being denoted only where necessary.

All the Malayan species are evergreen and I imagine this habit holds throughout the subgenus.

Leaves

Beside the distinction between bathyphylls and acrophylls, the leaves of certain species possess another important character which has been overlooked. The leaves of *F. apiocarpa, F. Bordenii, F. Scratchleyana* and *F. tawaensis* are simply tesselate on the underside, with flat areolæ between the reticulate veins. In all other species, these areolæ are pocked with white hairy pits in which the stomata are confined and thus, these species which have bathyphylls, again show a higher degree of vegetative

development. Indeed, I am convinced that the microscopic structure of the leaves will have an important place in the future classification of Ficus, though I have given the problem little more than the most superficial attention. Commonly the bathyphylls have no stomatal pits, but they may be found on the larger ones as well as on the transition leaves. *F. tawaensis,* so far as known, presents the intermediate state of a species with bathyphylls but without stomatal pits: it is just possible, however, that the acrophylls have not been collected. The stomatal pits are sub-epidermal in origin.

Between the species there are considerable differences in the size and shape of the leaves, but a few with different figs and flowers have very similar leaves, *e.g., F. apiocarpa* and *F. Scratchleyana, F. Bordenii* and *F. dens-echini, F. callicarpa multinervia* and *F. grandiflora, F. cataupi* and *Ficus tulipifera;* while in *F. callicarpa* there is much variation in the leaf and remarkable constancy in the receptacles. I consider that where the receptacles and flowers have exactly the same structure, leaf-differences must be varietal, and that where the receptacles and flowers are different, a similarity of leaf cannot outweigh the specific distinction. [I am inclined therefore to unite *F. geocarpa* and *F. Beccarii,* described in my former paper on Covellia (1).] But the status of *F. punctata* and *F. callicarpa* is most unsatisfactory.

The asymmetry of the leaf-base is most marked in species with bathyphylls and stomatal pits and is practically absent from those without these features. The asymmetry is another mark of specialisation in the leafy sprays of the climber.

Receptacles

The figs of Synœcia, which are among the largest and certainly the most beautiful in the whole genus, are very similar in structure and differ only in details of shape, colour, hairiness and position. These details nevertheless are characteristic and deserve some scrutiny.

In *F. apiocarpa* and *F. callicarpa,* many living specimens of which I have been able to examine, the general shape of the receptacle is so variable that I am led to doubt the value of this feature in any species until it has been proved from many collections. In contrast, the structure of the orifice, as seen in longitudinal sections, seems to offer reliable features and, as such can scarcely be conveyed by words, I have made drawings to scale from as many species as I had suitable material. The structure can be determined satisfactorily only in fresh specimens or those preserved in liquid, because the fleshy wall of the receptacle contracts strongly in drying and distorts the orifice.

A very short peduncle, a long neck and a little puckered mouth seem characteristic of *F. apiocarpa,* a perforate orifice of *F. barba-jovis,* large umbonate apical bracts of *F. dens-echini,* an umbonate apex of *F. punctata,* a rounded apex of *F. callicarpa.*

The colour of the ripening receptacle is characteristic, just as I found in Covellia and Neomorphe, but on this point there is too little information. Collectors should be urged to record the colours of fruits more carefully. I find, for example, that the marbling of the fig with pale spots is typical of *F. callicarpa, F. apiocarpa* and a few others, in contrast with *F. punctata* and those with very hairy figs. It seems that in all cases the fully ripe receptacles are deep purple or black and have a pleasant fruity smell. It is the colour that they turn before ripening that is distinctive and which renders them so vivid in the forest. In *F. callicarpa, F. apiocarpa* and, indeed, most species the figs change from light green through yellow and orange to brilliant red. In *F. punctata* and *F. tawaensis* they turn pink, orange-pink and pinkish red rather than orange-red. In *F. Bordenii* and *F. dens-echini* they are brown. In *F. Carri* they are olive brown to brownish purple. I have emphasized the importance of the colour in the key, on p. 95, because one is apt to be content with imperfect description.

In *F. apiocarpa, F. Scratchleyana, F. dens-echini, F. cataupi* and *F. trachycoma* the receptacles are axillary on the free-hanging leafy sprays, perhaps also in *F. Bordenii* but about this species there is no information. In the other species they are borne on the creeping stems on small woody knobs or leafless twigs that may elongate to a length of 10 cm., but the receptacles are never in big bunches as in Covellia. The axillary position is undoubtedly antecedent. Among the specimens of *F. callicarpa* there are a few which have unusually small, solitary axillary receptacles: I am inclined to regard them as the precocious fruit of young plants, but I have not found such living specimens myself. The axillary position in *F. trachycoma* and *F. cataupi* may also be found abnormal when these species are better known.

The largest figs are possessed by *F. tawaensis,* in which the body is said to have measured 12 cm. wide, and in *F. callicarpa angustifolia* of which I have seen a living specimen with the body (without neck) 14 × 10 cm. The smallest, apart from the little precocious axillary receptacles, are those of *F. tulipifera,* with the body 3 × 3.5 cm., and *F. cataupi* with the body 5 × 3 cm.

In *F. callicarpa angustifolia* the gall-figs are nearly twice as large as the seed-figs and they have a dingy colouring. Such a dimorphism in size occurs to some extent, I believe, in all species of Synœcia and is, doubtless, to be

related to the much greater enlargement of the gall- and male flowers after the entry of the wasps into the receptacle than of the female and neuter flowers. If different species of wasps can live in the same species of Synœcia, their specificity too may affect the size of the mature receptacle.

Concerning the biology of the fruits, one may remark that all animals seem to scorn these delightful objects. The gall-figs are naturally distasteful, being rather dry, when ripe, and full of insects, like those of Covellia and Neomorphe, but why should the seed-figs that are juicy and fragrant lie rotting on the ground? Malays always answer that neither birds, squirrels, monkeys nor bats will eat the fruits. Indeed, they commonly call the species of Synœcia "Tangisong Burong" with such other plants as have bright inedible fruits over which the birds shed tears of disappointment. The seeds must be dispersed, therefore, very gradually by rains, fortuitously by floods or, as in the case of the riparian *F. apiocarpa,* by river-flow.

The wasps emerging from the ripe figs carry a fair quantity of pollen. It seems, however, that little can remain on their shiny bodies after their struggle through the orifice and down the long array of internal bracts, and it is difficult to understand how many hundreds, even thousands, of seeds can be set in one receptacle by ordinary pollination. I believe that figs are parthenogenetic, though the wasps must in some way stimulate the development of the ovule.

The entomology of Synœcia is unknown. The figs harbour many inquilines as well as true fig-wasps and of these latter there must be several species, perhaps as many as there are species of Synœcia, if one can judge from the size and structure of the gall-flowers. Whether the development of the gall-ovary can be altered by the species of wasp or inquiline that inhabits it is not known but it seems probable when one considers the variations in size of the flowers in *F. callicarpa* and *F. punctata.*

Flowers

The large size of the flowers and, particularly, the long stalks of the male and neuter flowers, are characteristic of Synœcia. In my descriptions I have wherever possible taken the size of the flowers from mature receptacles because only such will give reliable and comparable figures. At their receptive stage in the half-grown figs, the gall- and female flowers, for instance, are minute and they enlarge in pedicel, perianth and ovary, though not in style, until the receptacle is nearly mature. The male flowers, also, are not full grown with expanded stamen until the wasps begin to fly out. At the receptive stage of the figs, the styles of the

gall and female flowers overtop their respective male and neuter flowers (Text Fig. 6) but subsequently the pedicels of these flowers elongate and they overtop the gall- and female flowers in mature receptacles. Thus, in their final size, the male flowers vary from 7–25 mm. overall, in the different species: *F. grandiflora* has the largest male flowers (20–25 mm. long) and the largest gall-flowers (up to 17 mm. long) though it is run very close by *F. callicarpa angustifolia: F. cataupi, F. Scratchleyana* and some forms of *F. callicarpa* and *F. punctata* have the smallest male flowers (7–9 mm. long). *F. dens-echini* has the largest female flowers (16 mm. long). In giving the size of the flowers it is important, also, to state the limits, especially of the gall- and female flowers, because short, tall and intermediate gall- and female flowers will be found, fully developed, in every receptacle, the difference in size depending on the relative development of pedicel and ovary-stalk. Concerning these two features, the distinction must be born in mind that the pedicel is proximal to the attachment of the perianth, the ovary-stalk distal. Thus, in *F. apiocarpa* and several others, the gall- and female flowers are more or less sessile but have commonly a long ovary-stalk, while in *F. dens-echini* they have a sessile ovary and a pedicel of greater or less length. In general structure, there is remarkable uniformity except the anomalous case of *F. apiocarpa* which lacks neuter flowers and has an almost colourless, membranous, denticulate perianth. In the other species, the perianth segments are wine-red, entire and more less thickly gelatinous. In the male flowers the perianth generally has 3 more or less gamophyllous, imbricate segments, but in *F. apiocarpa* there are 4 segments and in *F. Scratchleyana*, perhaps also in *F. dens-echini,* they are free. In the gall- and female flowers there are generally 3–4 perianth segments, free or slightly gamophyllous at the base, but in *F. grandiflora* and *F. dens-echini* there are commonly 5–6 and in *F. punctata* 0-3. In *F. apiocarpa, F. Scratchleyana* and, to some extent, *F. dens-echini* the perianth segments are relatively large, equalling or exceeding the combined length of ovary and style: in the other species they are generally much shorter. In *F. tulipifera* and *F. grandiflora* the segments are stout and often rather strongly gamophyllous. In all but *F. callicarpa,* the perianth-segments are simply attached by the whole base, like a multiseriate trichome, but in this one species the base of each segment is rounded and has a minute stalk placed a very short distance up the segment so as to form a tiny peltate attachment (Text Fig. 11). I consider this feature to represent an

advanced state, as I have not observed it in any other Ficus. *F. punctata* and *F. callicarpa* are very variable in size of flower and number of perianth-segments.

The opening of the male flowers is delayed, as usual in Ficus, until the wasps hatch. The anther is then exserted from the perianth in most, if not all species, but I find some uncertainty on account of the lack of fully mature receptacles. It happens very occasionally, that there are two stamens in a male flower (Text Figs. 3, 27, 29). In *F. callicarpa angustifolia* I found a few male flowers without stamens but containing a stalked, empty gall-ovary. The mature male flowers are always longer than the gall-flowers in the same receptacle.

The neuter flowers are like sterile male flowers. The perianth never opens but looks like a wine-red Crocus-flower in miniature. Sometimes it contains a sterile rod which resembles in shape an abortive pistil rather than a staminode. The neuter flowers generally overtop the female flowers in the same receptacle but in *F. Carri* they are of variable length. In *F. dens-echini,* perhaps also in *F. Scratchleyana,* the perianth segments are free.

Seeds

The seeds, too, are uniform and characteristic, with the single exception, so far as it is known, of *F. Carri* which has ovoid seeds without a flange: but these seeds may be abnormal. In size, they vary little from 1.6–2 mm. long in *F. punctata* to 2.2–3 mm. long in *F. apiocarpa* and *F. callicarpa parvifolia.*

The mature female flowers of *F. Bordenii, F. cataupi, F. tawaensis, F. tulipifera, F. grandiflora* and *F. barba-jovis* are not known.

It must be remarked how seldom collectors manage to gather both male and female specimens of diœcious plants.

Evolution of Synœcia

The evolution of long-stalked unistaminate male flowers, distributed thickly over the whole interior of the receptacle, of corresponding neuter flowers in the seed-figs and, as a consequence no doubt, the large size of the receptacle distinguishes Synœcia from other climbing figs. The origin of the subgenus is surely to be found in Eusyce in the affinity of *F. disticha* and *F. areolata.* Such species bear a distinct resemblance to the less specialised members of Synœcia, as *F. apiocarpa,* in having a similar creeping habit, tesselate leaves, stalked receptacles with male and neuter flowers distributed all over the interior and more or less flattened and flanged seeds, though they differ in their more or less sessile bistaminate male flowers and small

receptacles like the precocious axillary ones of *F. callicarpa*. Some recent collections of the late Mr. C. E. Carr suggest that in New Guinea there are species of Eusyce of even greater affinity with Synœcia, but I have not yet been able to classify them. *F. pumila* (Eusyce) looks, at first sight, like Synœcia but the restriction of the male flowers to a ring round the orifice and the structure of the perianth seem to forbid a close connection.

The species of Synœcia, like *F. callicarpa* and *F.* punctata, occupy one of the highest states of evolution in Ficus. They are climbers with specialised vegetative system and elaborate cauliflorous receptacles constructed on the principle of the two-phase development which gives the peduncle, collar and bractless body. In *F. apiocarpa, F. Scratchleyana* and *F. Bordenii* one finds the ordinary type of root-climber with unspecialised vegetative system and axillary receptacles. I have no hesitation in placing these species nearest to the stock from which Synœcia has sprung, and this conclusion is supported by the fact that *F. apiocarpa* and *F. Scratchleyana* have large sepals that are not, or scarcely, gamophyllous. *F. apiocarpa* I consider the most primitive in its membranous and almost colourless perianth, perhaps also in its lack of neuter flowers but it is impossible to decide whether this may not be a secondary feature through reduction or loss. *F. callicarpa* and *F. punctata* occupy the other end of the scale in having distinct bathyphylls and acrophylls borne on shoots of limited growth, stomatal pits, asymmetric blades, cauliflorous receptacles and small thickly gelatinous perianth segments. *F. tawaensis, F. dens-echini* and, perhaps also, *F. trachycoma* and *F. cataupi* occupy intermediate positions. *F. tawaensis* evidently combines bathyphylls and cauliflorous receptacles with symmetric leaves without stomatal pits whereas *F. dens-echini* combines symmetric leaves, axillary receptacles, rather large and thin perianth segments and, apparently, a lack of bathyphylls with the presence of stomatal pits, minute though they be. *F. trachycoma* and *F. cataupi* combine almost symmetric leaves and, apparently, axillary receptacles with stomatal pits and, probably, bathyphylls. It is not a little remarkable that the species should fall into such a graded series. Within the subgenus evolution has been mainly vegetative.

Distribution

Synœcia must have evolved in the centre of the Malaysian region, taking this term in its widest sense, and it may be said to have exceeded its limits only in Formosa. Lower Burma, Siam, (Indo-China), Formosa, New Guinea,

Distribution of the Species of Synœcia

—	Formosa	Indo-China	Tenasserim	Siam	Philippines	Sumatra	Malaya	N. Borneo	S. Borneo	Java	Celebes	Moluccas	Timor	New Guinea
F. callicarpa typical ..	..	..	+	+	..	+	+	..	+	+	?	..	..	..
parvifolia ..	+	?	..	..	+	..	..	+	..	..	+	+	+	..
angustifolia ..	..	..	..	..	+	..	+	+	..	..	..	..	..	..
crassinervia ..	..	..	..	..	..	+	+	..	+	..	..	..	..	..
multinervia ..	..	..	..	..	..	+	..	..	..	..	..	..	..	..
F. punctata	..	..	..	..	..	+	+	..	+	+	..	..	..	..
F. trachycoma	..	..	..	..	..	..	..	..	..	+	..	..	..	..
F: apiocarpa	..	..	..	..	..	+	+	..	+	..	..	..	..	..
F. Bordenii	..	..	..	..	+	..	..	..	..	..	..	..	..	..
F. cataupi	..	..	..	..	+	..	..	..	..	..	..	..	..	..
F. Scratchleyana	..	..	..	..	+	..	..	..	..	..	..	..	..	+
F. tawaensis	..	..	..	..	..	..	..	+	..	..	..	..	..	..
F. dens-echini	..	..	..	..	..	..	..	+	..	..	..	..	..	..
F. Carri	..	..	..	..	..	..	..	+	..	..	..	..	..	..
F. barba-jovis	..	..	..	..	..	..	..	+	..	..	..	..	..	..
F. tulipifera	..	..	..	..	..	..	..	+	..	..	..	..	..	..
F. grandiflora	..	..	..	..	..	..	..	+	..	..	..	..	..	..
F. Simiae?	..	..	..	..	..	..	..	..	+	..	..	..	..	..
F. singalana?	..	..	..	..	..	+	..	..	..	..	..	..	..	..
	1	1?	1	1	5	6	5	8	5	3	1	1	1	1

Timor and Sumatra mark the boundaries of the species, so far as they are known. None has been found in Peninsular or Himalayan India, Ceylon, the Andaman and Nicobar Islands, S. China, Queensland or the Pacific Islands. Such confinement is remarkable, unlike any other subgenus or natural group of Ficus, and I am inclined to think that it is caused primarily by the lack of seed-dispersal by animals (p. 87) and secondarily by the late evolution of the species, for why else, should *F. variegata* range unaltered from Assam to the Philippines and Hongkong to Java, while *F. callicarpa,* which commonly grows on *F. variegata* in Malaya and is equally at home in cultivation, is split up over the same area into a number of restricted varieties? Still more remarkable is the distribution of the individual species. It must be realised, however, that more intensive collecting will add greatly to our knowledge of the distribution of species, for instance in Sumatra, Borneo, Celebes, Timor and Flores, but one cannot wholly ignore the evidence of the last hundred years and I would lay stress on the recent work of Mr. Carr in Borneo and New Guinea. Mr. Carr had exceptional ability as a collector as I know from our joint expeditions in Malaya and Sumatra. In the neighbourhood of Mt. Kinabalu in Borneo for 7 months, and of Port Moresby and Mt. Victoria in Papua for 18 months, Mr. Carr searched specially for the wild figs and obtained very rich collections as his 4 new species of Synœcia from Kinabalu will testify. In Papua, moreover, he purposely had trees felled or climbed every day while he was in the forest so that he could obtain a representative collection of high trees, big climbers and epiphytes which others had been unable to reach. When, therefore, common species are not represented in his collections, one may reasonably conclude that they are absent from the area in which he collected and not that he had overlooked them, especially too, when Synœcias fruit at most times of the year and Mr. Carr spent several months on his collecting trips.

By far the richest development of Synœcia is in Borneo, where 9 species and 3 varieties have been found out of the total of 13 species and 4 varieties. (I have excluded *F. Simiae* and *F. singalana* from this discussion because they are doubtful). Six of these species appear endemic on or in the neighbourhood of Mt. Kinabalu, namely *F. tawaensis, F. Carri, F. dens-echini, F. barba-jovis, F. tulipifera* and *F. grandiflora,* but our knowledge of the Bornean flora is clearly too meagre for a definite statement and it is likely that more novelties will be discovered. It will be seen from the Table that, so far as is known, the Northern part of Borneo contains different species from the Southern. *F. apiocarpa, F. callicarpa* (*typica* and *crassinervia*) and *F.*

punctata were absent from both Mr. Carr's and the Clemens's collection from Kinabalu as well as from Elmer's in the neighbourhood of Sandakan.

Of the species that occur in S. Borneo, *F. callicarpa crassinervia* and *F. apiocarpa* occur in Malaya and Sumatra, while *F. callicarpa typica* and *F. punctata* are found in Java as well, but none of these reach to the islands north and east of Borneo so that one suspects that they have been distributed over the southern part of the Sunda-shelf. In contrast, *F. callicarpa parvifolia* and *F. callicarpa angustifolia* suggest a northerly distribution. One may say that *F. callicarpa typica* occupies the inner, southerly and westerly part of the Sunda-shelf and *F. callicarpa parvifolia* the outer northerly and easterly part without, apparently any overlap, unless it is to be discovered in N. Borneo and Siam.

After Borneo, come next in importance the Philippines with three species, *F. Bordenii, F. cataupi* and *F. Scratchleyana* and two varieties of *F. callicarpa.* The first two species are apparently endemic, the third is flung out to New Guinea presumably with some unknown connection in Ceram or the Moluccas, if not in Borneo and Celebes. (I am inclined to regard *F. Scratchleyana* as the eastern counterpart of *F. apiocarpa*). One finds, that is, the endemism of North Borneo in the adjacent Philippines. The only other endemic Synœcia is *F. trachycoma* of Java.

After the Philippines come Sumatra and Malaya with a very similar content, as one would expect from their proximity. Malaya has some connection with the Philippines and N. Borneo in *F. callicarpa angustifolia* but Sumatra has none. The affinity of the two countries is mainly with S. Borneo and Java.

In Java there are three species, *F. callicarpa, F. punctata* and *F. trachycoma,* the distribution of which lies strictly on the Sunda-shelf. It is strange that *F. apiocarpa* should be absent, though one cannot doubt the fact because it could not have been overlooked by the early botanists who collected before the lowland forest had disappeared.

The remaining countries Formosa, Tennasserim, Siam, Celebes, Moluccas, Timor and New Guinea contain but one species each, the distribution of which is a natural extension of its range from the centre of Malaysia. Whether a Synœcia occurs in Indo-China, I am uncertain because Gagnepain's description of *F. punctata* (Fl. Gen. de l'Indochine, V) suggests something quite different, perhaps Eusyce. The only record of a Synœcia from New Guinea is the type of *F. Scratchleyana,* presumably from Mount Scratchley. There can be no doubt that New Guinea, like

Burma, Formosa and Timor, lies at the very limit of distribution of the subgenus. The big collections which have been made this century in Dutch New Guinea have revealed no species nor has the big collection of Mr. C. E. Carr in Papua, through the Ficus-material of which I have purposely looked.

As for its altitudinal range, Synœcia belongs preeminently to the plains and lower mountain slopes. *F. apiocarpa* seems to be the one true lowland species, the others ranging from sea level to 1700 m.

One must conclude that Synœcia has evolved in Borneo. Three species which I consider primitive occur there, namely *F. apiocarpa*, *F. tawaensis* and *F. dens-echini* while the two others, *F. Bordenii* and *F. Scratchleyana,* occur so near that I expect they will also be found in North Borneo. Indeed, it may well be that every species occurs in Borneo, outside of which Synœcia may have no endemism. The most wide spread species is *F. callicarpa* which, in apparent contradiction to the theory of Age and Area, I hold to be, with *F. punctata,* the most highly developed, and neither the typical state nor any variety of *F. callicarpa* shows a distribution covering the whole range of the species. Evidently the parent species has disappeared and there remain only the widening 'wheels' of the varieties that it has 'dropped'. In greater detail one may not argue until more collections come to hand.

In climatic respect, it seems that all species belong to the rain-forest rather than the monsoon-forest, though *F. callicarpa parvifolia* may be a climatic variety in the more seasonal parts of Malaysia.

The Identity of *F. falcata* Thunb. and *F. punctata* Thunb.

When I had discovered the variation of *F. callicarpa* and the ease with which its bathyphylls might be mistaken for *F. punctata,* I determined to find out the exact identity of *F. falcata* and *F. punctata.* Both species were described from Java where, according to recent collections, both *F. punctata* and *F. callicarpa* occur. The solution of the problem is at once evident from the photographs of the type of each species, (Plates 3, 4), because they clearly represent the bathyphylls and the leaves intermediate between the bathyphylls and the acrophylls of the Javanese species which has always been identified as *F. punctata. F. falcata* represents the bathyphylls and, as it has always been reduced to *F. punctata,* the name may rest forgotten in synonymy. For these photographs I am greatly indebted to Prof. N. E. Svedelius as well as for his confirmation of the identity of Thunberg's two species by comparison with specimens typical of *F. punctata, F. callicarpa* and its



Type-specimen of *Ficus punctata* Thunb., ex herb. Thunb., Uppsala: (photogr. by C. G. Alm, 1937: by courtesy of Prof. N. E. Svedelius, Uppsala).



Type-specimen of *Ficus falcata* Thunb., ex herb. Thunb., Uppsala: (photogr. by C. G. Alm, 1937, by courtesy of Prof. N. E. Svedelius, Uppsala).

varieties, which I sent for the purpose. Prof. Svedelius writes that both Thunberg's specimens are sterile so that the possibility of Thunberg's species being my *F. callicarpa* var. *angustifolia* can be excluded only on the grounds of plant-geography: in the numerous collections of Synœcia from Java this variety of *F. callicarpa* is not represented.

Subgenus SYNŒCIA

Dioecious root-climbers, commonly with bathyphylls.

Leaves rather thick and leathery, *tesselate beneath, in many species with hairy stomatal pits.*

Receptacles large to gigantic, seldom less than 3 cm. wide, with a peduncle, a collar of three basal bracts and no lateral bracts, *ripening vivid yellow, pink, orange or red and finally purple-black,* in a few species brownish, commonly marbled with paler spots, *containing either male and gall-flowers or female and neuter flowers* (no neuters in *F. apiocarpa*).

Flowers generally large and long-stalked: perianth of 3–6 separate or more or less gamophyllous, thickly gelatinous, wine-red pieces, rarely absent (*F. punctata*-forms) or colourless and membranous (*F. apiocarpa*) : *all kinds of flower distributed throughout the receptacle.*

Male flowers with a very long white stalk, a gamophyllous perianth and a single stamen, overtopping the gall-flowers in the ripe receptacle.

Female flowers with a long style, bifid at the apex with a long and short arm.

Neuter flowers like sterile male-flowers, overtopping the female flowers in the ripe receptacle (except in *F. Carri*).

Seeds typically ellipsoid, flattened, with a narrow flange all round the body (? except *F. Carri*) : embryo straight.

Burma, Formosa, ? Indo-China, Malay Peninsula and Archipelago.

NATURAL CLASSIFICATION OF SYNŒCIA

Division 1

Leaves without stomatal pits, scarcely or not asymmetric: bathyphylls absent (except *F. tawaensis*) : receptacles axillary (except *F. tawaensis*)

Group 1

Bathyphylls absent: leaf-blade large, glabrous: petioles stout: receptacles glabrous, or sparsely hairy, marbled with pale spots, axillary (? in *F. Bordenii*)

A—Lateral veins 3–5 pairs: internal bristles absent or sparse: perianth of thin, irregularly denticulate, not gelatinous, white or pale pink segments: neuter flowers absent .. .. *F. apiocarpa*

AA—Lateral veins 6–9 pairs: internal bristles present: perianth of wine-red, entire, rather thick, gelatinous segments: neuter flowers present (? in *F. Bordenii*)

B—Leaf-base shallowly cordate: petiole 1–2 cm. long; male flower 12–17 mm. long, with gamophyllous perianth .. .. .. *F. Bordenii*

BB—Leaf-base not cordate: petiole 2–6 cm. long: male flowers smaller: the perianth of male and neuter flowers with 3 separate pieces .. *F. Scratchleyana*

Group 2

Bathyphylls present: leaf-blade small (up to 6 × 3 cm.), persistently hairy beneath, the base deeply cordate: petiole small: receptacles cauliflorous, persistently villous, not marbled .. .. *F. tawaensis*

Division 2

Leaves with stomatal pits, large, symmetric, the base equally cordate: bathyphylls ?: receptacles axillary, glabrous, marbled, broadly umbonate: internal bristles absent: female flowers very large, up to 16 mm. long; female ovary sessile: perianth of neuter-flowers with free or only slightly joined segments .. .. *F. dens-echini*

Division 3

Leaves with stomatal pits, more or less distinctly asymmetric: bathyphylls present: receptacles in most species cauliflorous: internal bristles present: female flowers not above 11 mm. long: perianth of neuter flowers gamophyllous

Group 1

Receptacles more or less glabrous at maturity, marbled with paler spots or pimples, generally not umbonate in the fresh state (often so when dried)

A—Leaf-blade more or less scabrid, with acute or acuminate apex, often almost symmetric: receptacles axillary

B—Blade broadly elliptic, up to 6.5 cm. wide: lateral veins 7–10 prs. very slightly raised on the underside of the blade .. .. *F. trachycoma*

BB—Blade narrowly elliptic, up to 3.6 cm. wide: lateral veins 5–7 prs., strongly raised on the underside of the blade .. .. .. *F. cataupi*

AA—Leaves not scabrid: receptacles cauliflorous

B—Male and gall-flowers with stout pedicels 1–2 mm. thick: gall-flowers with long pedicels and sessile ovaries wholly embraced by the 4–6 stout, often joined, perianth-segments: leaf shortly acuminate, nearly or quite symmetrical .. *F. grandiflora*

BB—Pedicels of male flowers slender, less than .5 mm. wide: gall-flowers

sessile or with short pedicels and a more or less stalked ovary, not or scarcely embraced by the perianth-segments

C—Perianth-segments of gall-flowers narrowly gamophyllous at the base: leaf-blade small, elliptic-lanceolate with acute apex: lateral veins 8–11 pairs, prominent beneath .. *F. tulipifera*

CC—Perianth-segments of gall-flowers free: blade very variable, with blunt or subacute apex and generally fewer lateral veins .. .. *F. callicarpa*

Group 2

Receptacles persistently and densely villous, generally umbonate in the fresh state, not marbled

A—Leaves very large and coriaceous, the blade about 17 × 7 cm., strongly acuminate, slightly inequilateral: lateral veins 7–10 pairs, very prominent beneath: petiole large, 3–4 cm. long: orifice of the receptacle deeply sunken: flowers very large: neuter flowers variable in length .. .. *F. Carri*

AA—Leaves much smaller, the blade less than 10 cm. long, not acuminate, distinctly inequilateral: petiole small, less than 1 cm. long: orifice of receptacle not or scarcely sunken: flowers not so large: neuter flowers of fairly constant length

B—Leaf-blade scabrid, strongly asymmetric with acute apex and very unequal base, cordate-auricled on one side, with glabrous stomatal pits: lateral veins 6–9 pairs, prominent and broad beneath: orifice of receptacle incompletely closed by the apical scales .. *F. barba-jovis*

BB—Blade smooth, not so strongly asymmetric, blunt, not auricled, with hairy stomatal pits: lateral veins 3–5 pairs, scarcely prominent fine: orifice of receptacles slightly sunken, effectively closed by the apical scales .. .. .. *F. punctata*

KEY TO THE SPECIES OF SYNŒCIA

Leaves simply tesselate beneath, without stomatal pits

Blade rather small, up to 6 × 3 cm., persistently hairy beneath, deeply cordate: petiole short, slender .. .. *F. tawaensis*

Not so: blade medium to large, glabrous: petiole stout

Blade with 3–5 pairs of lateral veins, the lateral basal veins reaching $\frac{1}{3}$–$\frac{3}{4}$ the length of the blade .. .. *F. apiocarpa*

Blade with 6–9 pairs of lateral veins
  Leaf-base shallowly cordate: petiole 1–2 cm. long .. .. *F. Bordenii*
  Leaf-base not cordate: petiole 2–6 cm. long .. .. .. *F. Scratchleyana*

Leaves tesselate on the underside with stomatal pits
  Leaf-base more or less cordate, symmetric: stomatal pits very minute: petiole 4–10 cm. long: blade not scabrid .. .. *F. dens-echini*
  Leaf-base cuneate or very asymmetrically cordate: petiole .5–4.5 cm.
    Blade distinctly scabrid on the upperside: apex acute
      Petiole .5–1.5 cm. long: blade almost symmetrical, ovate-elliptic: lateral veins rather faint on the underside *F. trachycoma*
      Petiole .3–1 cm. long: blade more or less asymmetric: lateral veins strong on the underside
        Base of blade strongly asymmetric, one side cordate-auricled *F. barba-jovis*
        Base of blade slightly asymmetric *F. cataupi*
    Blade not scabrid on the upperside
      Blade acute
        Petiole 2.5–4.5 cm. long: blade stiffly coriaceous with strong veins, 10–20 cm. long .. .. .. *F. Carri*
        Petiole less than 2.5 cm. long
          Petiole less than 1 cm. long: blade 1–3 cm. wide .. .. *F. tulipifera*
          Petiole 1–2.5 cm. long: blade 4–7 cm. wide
            Dried blade with the veins depressed on the upperside .. *F. callicarpa multinervia*
            Veins slightly raised on the upperside .. .. *F. grandiflora*
      Blade blunt, generally minute retuse, inclining to obovate
        Blade 6–12 × 4–7.5 cm., scarcely asymmetric: petiole .5–2 cm. .. *F. callicarpa*
        Blade up to 6 × 4 cm., more or less asymmetric and falcate: petiole up to 1 cm. long
          Veins thick and prominent beneath, depressed on the upperside .. .. *F. callicarpa crassinervia*
          Veins very fine, scarcely prominent beneath, not sunk above
            Blade 1–4 cm. wide, elliptic to obovate; base slightly asymmetric .. *F. callicarpa parvifolia*
            Blade 1–2 cm. wide, narrowly oblong elliptic, base distinctly asymmetric

Receptacles glabrous and marbled .. *F. callicarpa angustifolia*

Receptacles villous, not marbled .. *F. punctata*



Text-Fig. 1 *F. apiocarpa:* section through the orifice of the gall-receptacle, × 1½.

F. apiocarpa Miq.

Fl. Ind. Bat. Suppl. I. *1860–62,* p. 440.

Text Figs 1–4, 8, 37.

A big climber with a rather thin stem (up to 5 cm. thick), reaching 20–40 m. long; the low creeping stems rooting in the ground, *without bathyphylls.*

Stipules, young petioles and receptacles, and the underside of the main veins of the leaf varying sparsely hairy with short, pale brown, rather stiff, more or less adpressed hairs to softly downy with fairly close, short, white, spreading hairs: mature parts glabrous: in some cases the young parts also glabrous.

Leaves laxly spiral or apparently alternate on the hanging shoots: *blade* 10–34 × 4–13.5 cm., *large, elliptic, oblong or ovate, the base varying cuneate to distinctly though shallowly cordate, the apex more or less acuminate with a blunt or subacute tip* 5–20 mm. long, *nearly or quite symmetric,* coriaceous-chartaceous, rather thick, smooth, shining dark green, the underside pale green with a dark green reticulum of venules, drying yellowish to greyish green on the upperside and brown or greyish on the underside: *edge* entire or slightly sinuate, incurled in dried specimens: *primary lateral veins* 3–5 (–6) pairs, distinctly inarching near the margin, making an angle of 40–60° with the midrib, prominent beneath: *secondary lateral veins* scarcely prominent, irregularly transverse: *tertiary veins* distinct, not raised, commonly minutely tuberculate and enclosing more or less rectangular brown meshes (in dried specimens): *stomatal pits none: basal veins* 3(–5) *the outer two reaching* ⅓–¾ *the length of the blade* and making an angle of 30–40° with the midrib: *petiole* 1.5–

7.3 × .3–.4 cm., *long, stout,* brown, flaky in dried specimens: *stipules* 6–20 mm. long: *leaves* on shoots creeping on the ground smaller and more pointed but in no way specialised.

Receptacles axillary on the leafy twigs, singly or in pairs, hanging, *generally with a very short peduncle, a long neck and an ellipsoid body,* with more or less umbonate apex, glabrous or sparsely adpressedly hairy on the peduncle, and round the orifice: *apple green becoming orange-scarlet and then purple-black, marbled with small,* .5–1.5 mm. wide, *innate pale spots,* the surface dull and slightly roughened with numerous lenticels, without papillæ: peduncle 1.5–13 mm. long, 4–5 mm. thick: basal bracts 1–2 mm. long, puberulous: neck 5–30 × 4 mm.: body 44–58 × 29–40 mm: *orifice* slightly depressed, small: *internal bristles absent or scarce and minute.*

Male flowers 9–17 mm. high, pedicel 5–9 mm. or less, glabrous, white: *perianth* 3–5 mm. long, *composed of four,* rarely three, linear, *irregularly and finely denticulate,* glabrous, *membranous segments white or very pale pink with deeper pink edges, joined to form a cup for* ¼–⅓ *of their length,* in some cases becoming irregularly dentate-ramified and anastomosing to form a reticulum with the adjacent flowers: *stamens,* rarely two, with a slender filament 2.5–5 mm. long and *a large anther* 2–3 mm. wide.

Gall-flowers 3.5–6 mm. high, *sessile: perianth composed of four,* rarely three or five, *linear, flat, glabrous, irregularly and finely denticulate, membranous segments* 3.5–6 mm. long, free or slightly joined at the base, *coloured as in the male flower* and in some cases dentate-anastomosing in the same way, simply attached: *ovary* 1.5–1.8 mm. wide, sessile or with a short stalk up to 2 mm. long, rather humped: *style* .5–1 mm. long.

Female flowers 4.5–6.5 mm. high, *sessile: perianth* as in the gall-flowers, the segments 3–4.5 mm. long: *ovary* sessile to long-stalked: *style* up to 4 mm. long, shortly bifid, glabrous: *seed* 2.2–2.8 mm. long, yellowish, as in *F. punctata.*

Neuter flowers absent.

Habitat: in lowland swampy forest and by streams and rivers to moderate altitudes.

Distribution: Malaya (common), Sumatra, Borneo (south).

Collections:—

MALAYA:—

PENANG: Curtis 3508.

PERAK: Kunstler 4313, 5149, 6592, 10416, Scortechini s.n., Wray 1957, 2102.

MALACCA: Alvins 199, s.n. Malacca.

JOHORE: Corner 21186, 31463, Kiah 31957, Lake and Kelsall s.n. 1892, Ridley 1710.

SINGAPORE: Ridley 3400, 5614, 5615, 12562, s.n. 1892, s.n. 1894.
BANGKA: Teysmann 3237, 6855, 6871, 6372.
SUMATRA: Teysmann 796 (pr. Siboga).
BORNEO: Teysmann 7905 (Kapuas, S. Borneo).
PHILIPPINES: (No certain record: most specimens being *F. scratchleyana*).



Text-Fig. 2 *F. apiocarpa:* mature gall- and male flowers *in situ* with reticulate perianth segments, × 10.

This species is anomalous in several respects. Whether its features are primitive or have been derived by loss from the typical condition of the subgenus, it is impossible to decide but I am inclined to place it as the most primitive member on account of the lack of bathyphylls and stomatal pits to the leaves, of neuter flowers and of specialised, deeply coloured, gelatinous segments to the perianth as well as the axillary position of the receptacles. The large glabrous leaves with strongly ascending basal veins, the axillary figs with short peduncle and the almost colourless perianth are characteristic. With leaves only, care is needed to distinguish the species from *F. Scratchleyana*. It seems not to have been collected in recent years outside Malaya.

In some specimens perianth segments remain free but in others they become strongly anastomosed (Text Fig. 2). In these cases, when the flowers are full grown, the teeth of the perianth segments enlarge and apparently engage with those of adjacent segments, becoming stuck together so firmly that the flowers are embedded in a spongy mass and can be dissected only with the greatest difficulty, if at all.

F. apiocarpa has the same distribution as *F. callicarpa crassinervia.* The absence of both from Java is, I think, certain.

F. barba-jovis nov. spec.

Text-Figs. 5, 6, 35.

F. punctatae affinis: *lamina* 2–8.5 × 1–3.5 cm., *elliptica* vel elliptico-lanceolata, *valde inaequalis, falcata, basi unilateraliter cordato-auriculata, apice acuta,* subcoriacea, *scabrida, subtus plus minus pilosa, costis lateralibus utrinsecus 6–9,* subtus valde prominentibus, basalibus 4–5, *areolis foveolis glabris profundis praeditis:* petiolus 2–4 mm. longus.

Receptaculum cauliflorum, ellipsoideum, 4.9 cm. latum, *pilis longis* (2–3 mm.) *brevibusque* (.5 mm.) *dense et molle albo-villosum, ostiolo profunde perforato.*

Distr. British North Borneo, ad Koung, pr. Mt. Kinabalu, alt. 500 m.

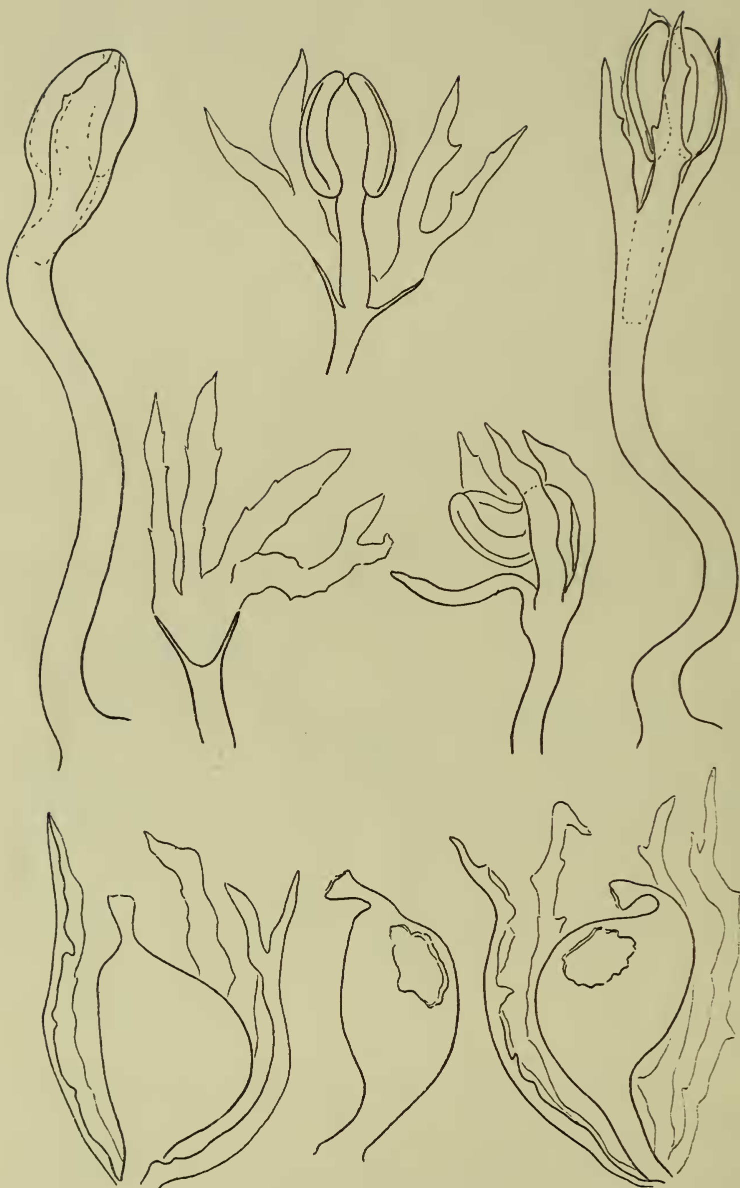
Typus:—S.F. No. 27305, leg. C. E. Carr, 13. 5. 33: "scrambling up a rock-cliff": spec. typ. in Herb. Sing.

Root-climber as *F. punctata:* stem up to 1 cm. thick: twigs slender.

Young twigs, petioles and leaf-blades rather sparsely hairy with lax white spreading hairs, 1–1.5 mm. long, the mature parts more or less glabrescent especially the uppersides of the leaves, the undersides generally rather persistently hairy: stipules finely adpressedly pubescent.



Text-Fig. 3 *F. apiocarpa:* mature gall- and male flowers dissected. × 10.



Text-Fig. 4 *F. apiocarpa:* mature gall- and male flowers dissected, × 10.

Leaves alternate: *lamina* 2–8.5 × 1–3.5 cm., *elliptic* or elliptic lanceolate, *strongly asymmetric, falcate, tapered gradually to the narrow, sharp apex* (not acuminate nor retuse), subcoriaceous, *scabrid especially on the upperside* from the persistent and swollen bases of the hairs, drying greyish greenish or pale greyish brownish on the upperside, light fawn-brown on the underside, the midrib and main veins very faint on the upperside, in some cases slightly raised, in others slightly depressed: *edge* slightly incurved or plane in dried leaves, minutely denticulate especially towards the apex: *primary lateral veins* 6–9 pairs, arising at a wide angle of 70–80° from the midrib, inarching to form a conspicuous marginal vein 1–1.5 mm. from the edge, drying light brown and distinctly raised on the underside: *secondary and tertiary veins* scarcely raised, distinct, reticulate, *with deep, glabrous pits* in the meshes: *base very unequal, strongly cordate-auricled on one side,* the auricle as long as or longer than the petiole and often slightly overlapping the stem, cuneate or narrowly subcordate on the other side, with 4–5 basal veins: *petiole* 2–4 mm. long, 1 mm. wide, short, slender, becoming brown-scurfy in dried specimens: *stipules* 4–10 mm. long, lanceolate.

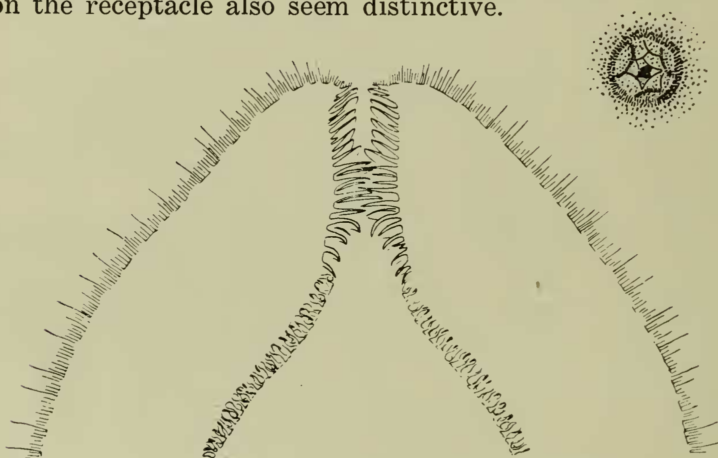
Receptacles solitary on short, woody bracteate tubercles on the stem, greyish green when young *becoming bright rose-pink* (? colour when ripe), *wholly villous: peduncle* 5 mm. long and wide, thick, densely hairy as the body: *basal bracts* 3, 5–6 mm. long, lanceolate triangular, acute, shortly and closely adpressedly hairy on the outside, closely adpressed to the body: *body* up to 7.2 × 4.9 cm., ellipsoid, rather narrowly barrel-shaped, slightly contracted near the apex but not truly umbonate, sessile on the peduncle without any neck, *wholly thickly and softly white hairy with long, looser hairs* (2–3 mm. long) *arising from a dense pile of short hairs* ca. .5 mm. long: *orifice* 3 mm. wide, flush with the surface, with three shortly villous marginal apical scales and *incompletely closed by the internal scales leaving a small central hole: internal* bristles not numerous, ca. .5 mm. long.

Male flowers with a wine-red subgelatinous perianth, gamophyllous for ½–⅔ its length, with three hooded lobes: stamen 1.

Gall-flowers sessile: *perianth* of 3–4 free, simple, entire, firmly gelatinous, wine-red segments, simply attached: stigma discoid, serrate.

I describe this species from dried twigs with small receptacles and from one large receptacle in spirit. In this specimen the flowers are still minute, though the gall-flowers are at their receptive stage. The structure of the flowers can readily be made out but I have not considered it worth

while to give any measurements. To what size the receptacles may reach, I do not know nor can I decide whether the leaves are bathyphylls or acrophylls. Nevertheless there can be no hesitation in naming such a striking species. It is distinguished by the large, thickly and softly villous, or lanuginous, receptacles with deeply perforate orifice and the small very asymmetric, scabrid leaves with semi-auricled base and very prominent main veins on the underside. The basal bracts of the receptacle also are longer than in any other species. The stomatal pits are not hairy but that may be because the leaves may be bathyphylls. The absence of a neck to the receptacle is, perhaps, specific but this feature is very variable in other species and the material is insufficient to decide. The two kinds of hair, long and short, on the receptacle also seem distinctive.



Text-Fig. 5 *F. barba-jovis:* section through a young gall-receptacle, × 2, the orifice × 3.



Text-Fig. 6 *F. barba-jovis:* young gall-flowers (at the receptive stage) and immature male flowers *in situ:* perianth-segments of gall-flowers in black: × 10.

The species is undoubtedly near *F. punctata.* Its leaves, however, are extraordinarily like those of *F. cataupi.*

F. Bordenii Merrill
Govt. Lab. Publ. Philip. 29, *1905,* p. 11.
Text-Figs. 7, 36.

A root-climber like *F. apiocarpa* with rather thick twigs drying light brown.

Stipules, young twigs, petioles and undersides of the leaves finely adpressedly hairy, becoming more or less glabrous: the underside of the midrib and main-veins with a few longer bristle-like hairs: *upperside of the leaves subscabrid* with small stiff hairs or their persistent bases, weathering smooth.

Leaf-blade 7.5–14 × 3–6 cm., *narrowly ovate,* symmetrical, tapered gradually to the shortly subacuminate, subacute apex, not retuse, *the base distinctly but shallowly cordate,* in some cases simply rounded, symmetrical *subcoriaceous,* dark green on the upperside, tesselate beneath, the edge entire or slightly uneven, *drying* light greyish greenish on the upperside with the veins showing as fine slightly raised lines, *rather silvery brownish on the lowerside with small brown spots in the reticulations: primary lateral veins* 6–9 pairs, arising at a rather acute angle, ca. 50°, inarching near the margin but without a distinct marginal vein, narrow and distinctly raised on the underside in dried leaves;: *secondary veins* subparallel but reticulate along the mid-line between the primary laterals, very slightly raised as fine lines on the underside of the dried leaf: *tertiary veins* reticulate, distinct but not raised, *without stomatal pits* in the areolæ though with brown spots: *basal veins* five: *petiole* 1–2 cm. × 2 mm., becoming brown scurfy or flaky: *stipules* 5–15 mm. long, lanceolate.

Receptacles (? position) finely and rather sparsely adpressedly puberulous, brown: *peduncle* 1–1.5 × .25 cm., adpressedly puberulous: *basal bracts* 3, 3–5 mm. long, lanceolate, rather spreading in the dried specimen, slightly puberulous: *body* apparently globose, 5–6 cm. wide without a neck: *orifice* 4 mm. wide, slightly projecting in the dried specimen and with numerous internal bracts projecting ca. 5 mm.: *internal bristles* abundant but short and inconspicuous.

Male flowers 12–17 mm. long overall, often with a linear wine-red bracteole (like a perianth-segment of the gall-flower) attached near the base of the stalk or half-way up: *perianth* 1.5–1.8 mm. long, wine-red, gamophyllous with three, occasionally two, apical lobes: *stamen* 4–5 mm. long overall: *anther* 1.5 mm. long.

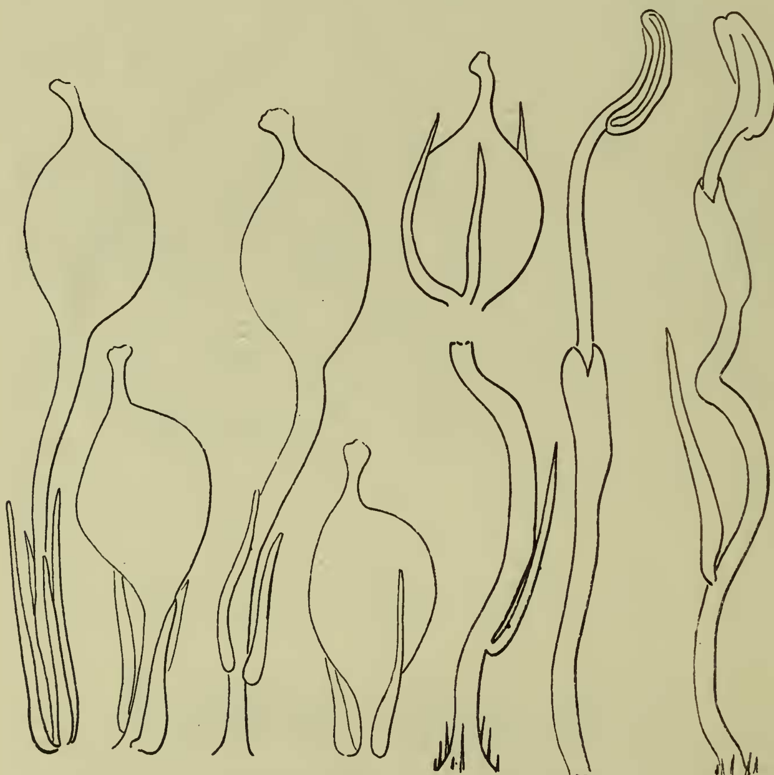
Gall-flowers 3.5–9 mm. long overall, sessile or with a short stalk up to 1 mm. long: *perianth* of 3–4 linear-lanceolate, entire, subgelatinous, wine-red segments 2–3.7 mm. long, occasionally two segments joined at the base, generally simply attached, in some cases peltate: *ovary* sessile or with a stalk up to 5.5 mm. long, the ovary itself 1.5–1.8 mm. wide: *style* .7–1 mm. long with a serrulate stigma.

Female and neuter flowers and seeds unknown.

Distr. Philippines.

Collections:—Philipp. For. Bur. 1211, leg. T.E. Borden, Lamao R., Luzon, ca. 650 m., June 1904, hill-forests (Type).

This species is known only from the type-collection. It is close to *F. dens-echini* which has larger, acuminate leaves with fewer veins rising at a much wider angle, stomatal pits and longer petioles. The receptacles seem also to differ in shape and structure of the orifice.



Text-Fig. 7 *F. Bordenii:* mature gall- and male flowers from the type-collection: × 10.

F. Bordenii is one of the simpler members of the subgenus.

F. callicarpa Miq.

Ann. Mus. Lugd. Bat. III, *1867,* p. 268, 289, t. 10 fig. A, B.

Text. Figs. 8–11, 30, 31.

Young shoots hairy with rather long white hairs, especially on the twigs and petioles and these with rather stiff adpressed hairs: the undersides of the leaves sparsely hairy: the uppersides nearly glabrous from the first: *all parts soon glabrescent,* except the persistently hairy peduncle, and edges of stipules and bracts.

Leaves alternate: *blade* 4.5–12 × 3–7.6 cm., *generally large, elliptic to subobovate,* gradually narrowed to apex and base, broadest about the middle, or above or below, slightly inaequilateral, inclining to subrhomboidal, coriaceous, glabrous, often slightly scabrid beneath, when fresh rather yellowish green above and shiny, *white-tesselate beneath,* with minute hairy pits, drying greyish or yellowish green above and greyish brownish beneath: *edges* entire, distinctly incurved in dried specimens: *apex* obtuse or subacute, rarely subacuminate, often minutely retuse; *primary lateral veins* 3–6 pairs, slightly raised on both sides of the dried leaf: *secondary lateral veins* faint, irregularly reticulate, *the areolae on the underside containing white hairy pits: base* rather strongly narrowed, rounded cuneate or minutely and narrowly cordate, equal or slightly cordate on one side, with three basal veins.

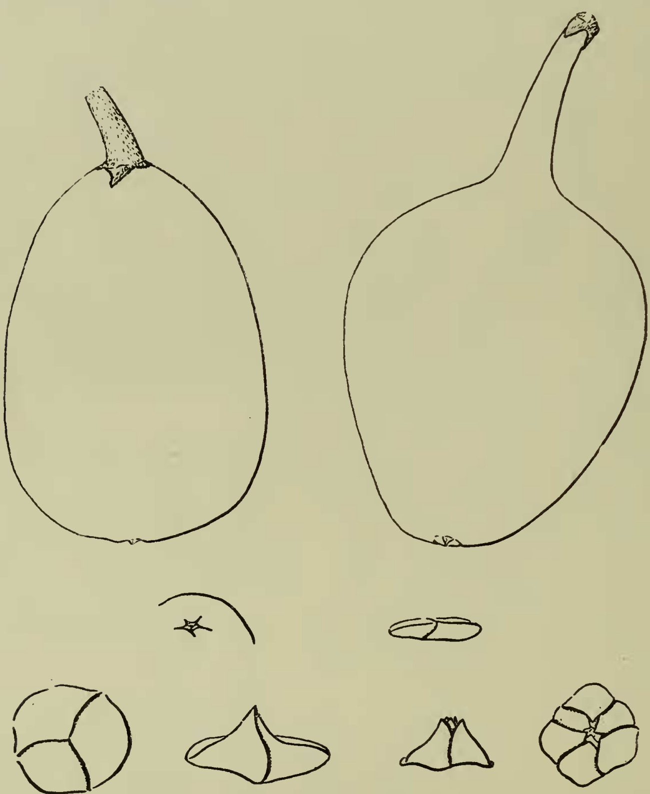
Petiole 5–20 × 1.5–2 mm, becoming brown flaky.

Stipules 5–13 mm. long, lanceolate acute, soon glabrous except for the ciliolate edges, generally caducous.

Bathyphylls: blade 1.5–5 × .2–1.2 cm, as the foliage leaves but narrower, more asymmetric, and thinner, generally strongly inaequilateral with the narrow side of the blade disposed acropetally, more or less falcate, the base often slightly cordate-auricled on one side: *primary lateral veins* 4–7 prs.: *petiole* 2–6 mm. long.

Receptacles borne as in *F. punctata* on woody tubercles up to 10 × 1 cm.; *massive, short or long stalked, obpyriform, ellipsoid or pyriform, smooth,* not umbonate or warted; puberulous round the orifice and very minutely scurfy with brown dots, in some cases finely and sparsely puberulous, *becoming glabrous, ripening brilliant orange to carrot-red and finally black, always marbled with paler elliptic transverse spots, some large 1–3 mm. long, and many smaller ones between the larger: peduncle* .2–2 cm. long × .3–4 cm. at the base and 4–7 mm. at the apex, slightly thickened

distally, usually with a small tumid band at the collar, for a long time puberulous with minute white adpressed bristly hairs, eventually dull orange: *basal bracts* 3–5 mm. long × 4–6 mm. wide, three in a collar, often grouped to one side of the peduncle, triangular acuminate, faintly keeled, adpressed, puberulous with bristly adpressed minute hairs especially on the keel, glabrescent, except along the edges; dull orange then blackening: *body* 4–10 × 3–8.5 cm, the neck 0–3 × .5–.8 cm.: *orifice* 3.5–6 mm. wide, rounded-angular, slightly depressed and *surrounded by a shallow groove, closed by 3–5 ± erect, acuminate, imbricate apical bracts forming an acute, projecting cone,* and similar to the basal bracts: *internal bristles* .1–.5 mm. long, abundant but very inconspicuous.



Text-Fig. 8 *F. callicarpa: above,* two extreme forms of receptacle, nat. size: *middle,* the orifice of the receptacle of *F. apiocarpa* (left) and of *F. punctata* (right) × 3: *below,* the orifice of the receptacle of *F. callicarpa,* × 3.

Female flowers 4–7 mm. high, sessile or with a short stalk up to 1.5 mm. long: *perianth of 3–4 free, lanceolate,* tumid, entire, glabrous *segments,* 1–3.5 mm. long, adpressed to the ovary and *with a minute peltate attachment,* in a whorl or arranged spirally: *ovary* sessile or with a stalk up to 2.5 mm. long: *style* 1–2.5 mm. long, subterminal, straight, with a bifid stigma, the arm projecting over the ovary longer than the other.

Neuter flowers 5.5–7 mm. high: *pedical* white, glabrous: *perianth* 1.5–2.5 mm. long, composed of 2–3, generally 3, linear-lanceolate or subspathulate, glabrous wine-red segments, free or united to the middle with the tips overlapping and often hooded but eventually separating and giving the shape of a crocus-flower: often with a sterile rod or abortive pistil inside the perianth, never a stamen.

Gall flowers 4.5–9 mm. high, sessile or shortly stalked: *perianth* as in the female flowers, but the segments 3–6 mm. long: *ovary* 2–2.5 mm. wide, ovoid, sessile or with a stalk to 5.5 mm. long, style .5–1.2 mm. long: stigma denticulate.

Male flowers 15–19 mm. long: *pedicel* glabrous, rather flexuous, white: *perianth* 2–2.5 mm. long, wine-red, gamophyllous, cleft for ½–⅓ of its length into 2–3 subacute segments: stamen 2.5–7 mm. long, the anther just exsert at maturity.

Seeds 1.8–2 × .8 × .4 mm., strongly flattened, elliptic in outline with a faint hilum and prominent longitudinal flange round the body, smooth, straw yellow: embryo straight.

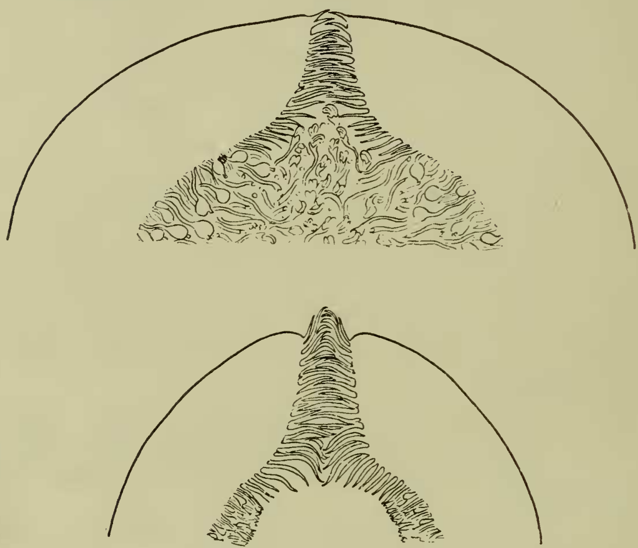
Hab.: in lowland forest, also to moderate altitudes (400 m.) : common in villages and orchards.

Distribution:—Burma (Tenasserim), Peninsular Siam, Malaya, Sumatra, Java, Anamba and Natuna Islands, Borneo (South), Celebes? (Koorders 19180, Minahassa, with leaves exactly intermediate between *F. callicarpa typica* and *F.c.parvifolia*).

Collections:—

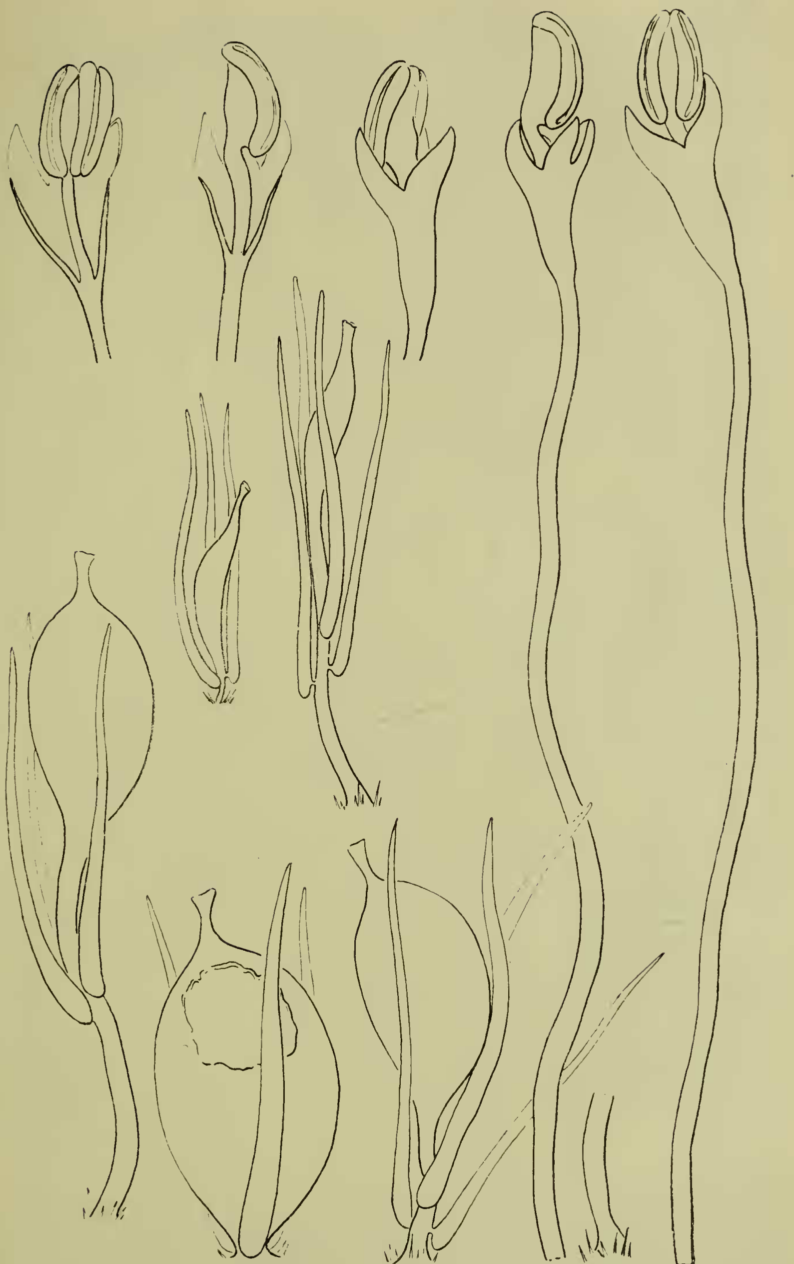
TENASSERIM: Falconer 1026 (Moulmein); Meebold 14517 (Maunglow), 14683 (Duriaan).
SIAM: Kiah 24354 (Kampengpet, L. Siam).
MALAYA:—
Penang: Curtis 3507, s.n. 1892, Ridley s.n. 1898.
Trengganu: Corner 25835, 33489.
Perak: Burkill 13982, 13988, Kunstler 147, 7949, Scortechini s.n., Wray 2022.
Pahang: Burkill 17193, Henderson 21687 (P. Tioman), Ridley s.n., 20.8.89.
Negri Sembilan: Burkill 6429 (det. *F. aurantiaca*).
Malacca: Alvins 986, Corner 26134, Goodenough 1370.
Singapore: Bayliss s.n. 1894, Corner 28183, Ridley s.n. 1892, s.n. 1894.

SUMATRA:—
Achmad 866 (P. Simaloer), Bunnemeyer 1067 (Ophir district).
Forbes 3224 (R. Rawas), Lorzing 7258 (Sibolangit), Yates 1522 (Sibayak).
JAVA: Koorders 15443, 21380, 32238, 38045, Mousset 511.
BALI: Maier 291.
ANAMBA AND NATUNA ISLANDS: v. Steenis 865.
BORNEO: Teysmann 7906, 11311, 11512, (all from S. and S. W. Borneo).
CELEBES: Koorders 19180 (possibly *F. callicarpa* var. *parvifolia*).

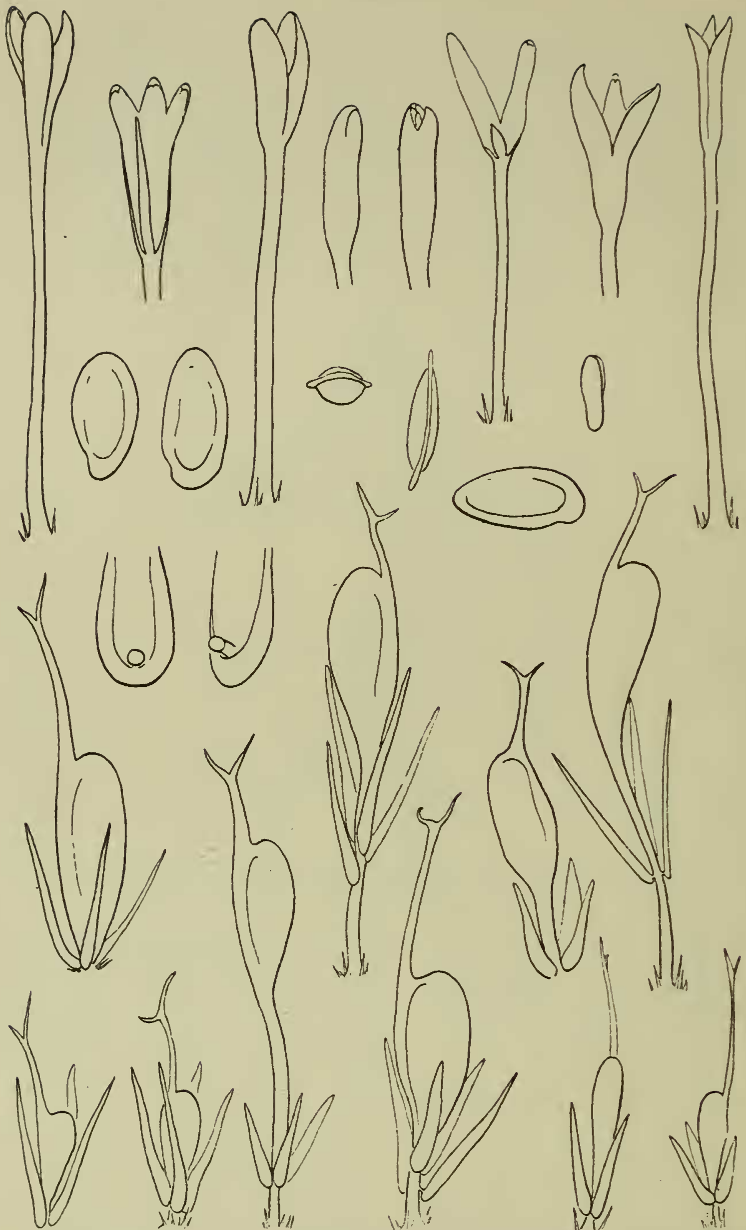


Text-Fig. 9 *F. callicarpa:* sections through immature (below) and mature gall-receptacles, × 1½.

This species appears limited, in its typical state, to the western and southwestern part of Malaysia. It has not been found west of Tenasserim or east of Celebes (if it really occurs in that island). It is a common species—— in Malaya the commonest Synœcia ——— and as it delights in climbing village trees, the extermination of lowland forest offers no barrier to its dispersal. It is not represented in the rich gathering of figs made by Mr. Carr on Mt. Kinabalu nor has it been found in the Philippines, where it can hardly have been overlooked. Why is this state, *F. callicarpa typica,* found in the South of Borneo and not in the North, in Java and not in India or Indo-China? It seems that its distribution is limited by a climatic barrier, to the north and east of which it is substituted by *F. callicarpa parvifolia.* That barrier may be the more prolonged



Text-Fig. 10 *F. callicarpa:* mature gall- and male flowers, × 10.



Text-Fig. 11 *F. callicarpa:* mature neuter and female flowers, with 5 seeds, an embryo and the bases of two perianth-segments from a female flower showing the peltate attachment (highly magn.): × 10.

influence of the dry monsoon. (The record of *F. callicarpa* from Timor, Forbes 3687, is really *F. callicarpa parvifolia*).

In making four varieties of *F. callicarpa,* I argue that when the receptacles and flowers have identical shape, structure and colouring, varying only in size, and the differences are merely in the leaves, in their size and shape, such differences have less than specific value. There is, indeed, evidence that plants occur intermediate between the varieties: collections of such I have mentioned under the varieties. The variability of *F. callicarpa* is not realised. As with *F. punctata,* there are great differences in the size of the flowers and in the degree of gamophylly in the male and neuter perianth but each collection, and presumably each plant, is constant in such features. I consider that *F. callicarpa* has evolved, or rather is still evolving, by producing more specialised vegetative conditions, particularly in the distinction between bathyphylls and acrophylls and in producing smaller leaves so that such states as var. *parvifolia* and var. *angustifolia* may have been derived from the typical state and this from *F. Simiae. F. callicarpa crassinervia* and *multinervia* have evolved for some reasons, doubtless connected with the climbing habit, peculiarly thickened veins. When they are better known, *F. trachycoma, F. cataupi* and *F. tulipifera* may be classified better as varieties of *F. callicarpa,* but many more collections of Synœcia are needed especially from Sumatra, Borneo, Celebes, Timor and, perhaps, Flores, before a conclusion can be reached. The unsatisfactory distinction between *F. callicarpa* and *F. punctata,* I have discussed under that species.

According to King, the perianth of the male and neuter flowers is composed of three separate pieces but such is seldom the case, and his statement that the perianth of the female flower is composed of 1–2 pieces is also not true.

Gall-flowers are absent from the immediate neighbourhood of the orifice of the receptacle so that there are 2–3 rows of male flowers only, but there is no structural modification of the flowers near the orifice. In the seed-receptacles the female flowers next the orifice commonly have an abortive ovary or none at all and the neuter flowers are also reduced in size.

In Trengganu, I collected specimens of a gall-plant (S.F. No. 33489) which was remarkable in having very large pale receptacles. The body of the biggest measured 10 × 8.5 cm. (excluding the neck). The unripe body was green and very faintly marbled, then turned yellowish and became slightly flushed reddish or vinaceous as it ripened but never orange or scarlet nor purple black when fully

ripe. Such colouring is exceptional: c.f. *F. callicarpa angustifolia* (gall-figs).

KEY TO *F. PUNCTATA* AND *F. CALLICARPA*

Receptacles persistently and wholly villous
  Lamina small, elliptic-obovate to lanceolate-obovate with fine veins, 1.5–4.7 × .6–2.5 cm. .. *F. punctata*
Receptacles glabrous, occasionally sparsely hairy when young .. .. *F. callicarpa*
  Veins of leaf thick and prominent on the underside, sunken or impressed on the upperside; lamina up to 6 × 3.5 cm. .. .. *F. callicarpa crassinervia*
  Veins fine, scarcely raised on the underside, not sunk on the upperside
    Lamina 5–12 × 3–7 cm., rather large .. *F. callicarpa typica*
    Lamina up to 6 × 4 cm.
      Lamina 1–4 cm. wide, elliptic to obovate, the base slightly asymmetric .. *F. callicarpa parvifolia*
      Lamina 1–2 cm. wide, narrowly oblong-elliptic, base distinctly asymmetric .. *F. callicarpa angustifolia*

F. callicarpa var. **parvifolia** var. nov.

Text. Fig. 32.

Synonyms

F. megacarpa Merrill, Govt. Lab. Publ. (Philip.) 17, *1904*, 14.

F. terasoensis Hayata, Ic. Plant. Form. VIII, *1919*, p. 116, t. XV.

Lamina minor 1.8–6.2 × .7–4 cm., basi plerumque inæquilateralis uno latere cuneata altero anguste cordata, apici rotunda, obtusa, minute retusa: *petiolus brevior*, 1–10 × 1 mm.: *bathyphylla* breviora, ut in *F. punctata*, usque ad 2.4 × 1 cm.

Distr. Malaya, Indo-China?, Formosa, Philippines, Brit. N. Borneo, Celebes, Timor, Moluccas.

Other data:—

Leaves:—*blade* generally rather broadly elliptic, broadest at the middle, varying narrowly elliptic-oblong, elliptic-obovate or elliptic ovate, generally asymmetric, occasionally with symmetrical leaves on the free-hanging branches; *edges* of dried leaves in some cases rather strongly incurved: *base* occasionally symmetric and then rounded cuneate to shallowly cordate: *primary lateral veins* 3–5 prs., in dried leaves very faint above, slightly raised beneath, distinctly inarching near the margin: *basal veins* 2–4, often suppressed on the narrow side.

Receptacles often closely and finely villous when young as in *F. punctata,* becoming more or less glabrous and marbled.

Male flowers very variable in size, in different collections, 8–17 mm. long: *perianth* 1–2 mm. long, occasionally with 4 lobes: *stamens* up to 5 mm. long, very occasionally 2 stamens in each flower.

Gall flowers 4–13 mm. long, stalk up to 4 mm. long, *perianth* of 1–4, generally 3, segments 1.5–3 mm. long: ovary-stalk up to 9 mm. long.

Female flowers as in *F. callicarpa typica:* rarely only 2 perianth segments.

Neuter flowers 4–5 mm. high.

Seeds 2.2–3 mm. long.

Hab.: lowland and mountain forest to 1700 m.

Collections:—

PHILIPPINE ISLANDS: Barnes 322, Borden 222, Clemens 979, 9351, s.n. June 1907, Cuming 1927, Curran 10611, Edano 75892, Elmer 6102, 6757, 7471, 7506, 13932, 15393, 15613, Fenix 4104, For. Bur. 27876 (Palawan), Harder 5874, McGregor 10229, Merrill 782, Merritt 7759, Oro 30822, Ramos 13727, 14726, 16636, 80172, 80266, Robinson 9229, Sajor 31094, Villamil 20971, 21386, Wenzel 3161, Williams 559.

BORNEO: Carr 26492, 27761, Clemens 31336 (all from Mt. Kinabalu).

CELEBES: Koorders 19180 (this may be typical *F. callicarpa*), Kjellberg 2887.

TIMOR: Forbes 3687.

MOLUCCAS: Boerlage 315, Rant 131, Robinson 182.

FORMOSA: Sata 81 (Taiwan).

INDO-CHINA: (evidently the plants described as *F. punctata* in Fl. Gen. Indoch.).

That *F. megacarpa* is only a variety of *F. callicarpa* with smaller, rather differently shaped leaves is borne out by the fact that in some collections of *F. megacarpa* many of the leaves are so large as to pass for those of *F. callicarpa* and it is very difficult, if not impossible, to know how to classify such as Ramos 80266, Fenix 4104, Forbes 3687, Elmer 14726 and Koorders 19180; the first four of these I have decided to class with var. *parvifolia,* chiefly on grounds of distribution but Koorders' collection from Celebes may well be *F. callicarpa typica.* Moreover, the identification of bathyphylls and leaves of intermediate shape is very difficult, if not impossible, because the leaves of *F. megacarpa* which are intermediate between bathyphylls and acrophylls may be identical with the bathyphylls of *F. callicarpa,* e.g. Elmer 6102, Curran 10611. The receptacles and flowers of *F. megacarpa* are exactly similar to those of *F. callicarpa* and the trifling differences in size may disappear when a larger series of specimens is examined. Only, the seeds of *F. megacarpa* seem distinctly bigger. The identity of *F. terasoensis* has been established by Sata (5), and I have been able to examine a specimen

from Formosa. In choosing a name for this variety, which it is necessary to distinguish for geographical reasons in spite of the occurrence of intermediates, I have preferred one that will indicate its character rather than retain its first or second specific epithet, neither of which has significance.

If *F. punctata,* described by Gagnepain (Fl. Gen. Indo-chine, V, 813) is a Synœcia, it probably belongs to this variety. But the small receptacles (12–30 mm. long) with long stalks (6–50 mm. long) and the free sepals of the male flower suggest Sycidium, or Eusyce.

On the label of the type-specimen of *F. megacarpa,* it is noted "*F. megacarpa* Merr.= (*F. elliptica* Miq. non H.B.K.)" and on another sheet in the same cover is a small collection of leaves of Cuming 1927 on which *F. elliptica* Miq. is said to be based. These are identical with the leaves of *F. megacarpa.* But King cites this number under *F. disticha* so that I imagine Cuming's collection was mixed. King would surely not have referred such leaves, tesselate with stomatal pits, to *F. disticha.*

In distribution, *F. callicarpa parvifolia* occupies the central and northern part of western Malaysia, in the widest sense of the term. It overlaps the typical *F. callicarpa* only in Borneo and perhaps Celebes. It is remarkable that the typical state, so common in Malaya, should be absent from the Philippines and yet the species should be abundantly represented there by a variety which is absent from Malaya.

The young figs of this variety are usually rather closely hairy and, as they may retain their pubescence until more than half grown, they tend toward the hairy condition of *F. punctata.* Indeed, in reduction of leaf-size and in the incipient villosity of the receptacle, this var. *parvifolia* leads towards *F. punctata.*

F. callicarpa var. **crassinervia** var. nov.

Text. Fig. 33.

Lamina minor 2–6.2 × 1.1–3.6 cm., *elliptica vel ovata, lata, obtusa, inaequilateralis vel rhombica, basi valde asymmetrica uno latere profunde cordata vel saepe subauricalata.*

Lamina sicca, costa costaeque laterales magnae crassae, superne in lamina rugulosa plus minus profunde depressæ, inferne prominentes, fuscobrunneæ, longitudinaliter striatulæ, areolis magnis pilosis.

Distrib. Malay, Sumatra, Sarawak (pr. Kuching).

Typus. S.F.N. 28446 (Corner, Johore).

Other data:

Leaf: blade rather thin, occasionally symmetric, elliptic to elliptic-obovate with cuneate base on the free-hanging

twigs; primary lateral veins 3–7 pr., basal veins 3–5: petioles 3–10 × 1–1.5 mm.

Bathyphylls as in *F. callicarpa parvifolia* but with more conspicuous veins.

Female flowers: ovary-stalk to 4.5 mm. long, the flower up to 9 mm. long overall.

Hab. in lowland and mountain forest to 1200 m. occasionally in villages.

Collections:—
MALAYA:—
PENANG: Curtis s.n. 1892.
PERAK: Burkill 12795, Kunstler 7823, Ridley 14044, Wray 2231.
PAHANG: Corner s.n. 30.10.32, Siemund 591.
JOHORE: Corner 28446, s.n. 2.4.34, Down 133.
SINGAPORE: Ridley s.n. 1892.
SUMATRA: Jacobson 2190 (W. Coast), Postumus 678 (S. Manau, Djambi).
BORNEO: Hullett s.n. 19.7.90 (pr. Kuching, Sarawak).

Some collections of this variety were determined by King to be *F. punctata falcata* but King's "falcata" covers also the bathyphylls of *F. punctata, F. callicarpa* and *F. callicarpa parvifolia* and, being without typification, one must regard it as a "mixtum compositum". Var. *crassinervia* is clearly a further advance on var. *parvifolia* having leaves of similar shape and size but with strongly asymmetric base and curiously thickened, pronounced veins. Some collections of var. *parvifolia* from North Borneo have a slight thickening of the veins but they are not comparable with the Malayan and Sumatran specimens.

The distribution of var. *crassinervia* shows the close affinity of the floras of Sarawak, Malaya and Sumatra to the exclusion of Java, which country seems to have been separated on the Sunda-shelf before the other three and so to have missed many of the 'Kuching-Johore-Palembang' immigrants.

After *F. callicarpa typica,* this var. *crassinervia* is the next most abundant Synœcia in Malaya. The closely adpressed bathyphylls, short leafy twigs with dark shiny foliage and the brilliant cauliflorous fruits make it an ivy-like creeper worthy of cultivation and far excelling *F. repens* in beauty.

F. callicarpa var. **multinervia** var. nov.

Text. Fig. 34.

Lamina major, 7–12 × 4–6.4 cm., elliptica, plus minus symmetrica, basi cuneata haud vel vix asymmetrica, *apice breve subacuta: costae laterales plures, utrinsecus 7–9.*

Distrb. Sumatra.

Typus: Lorzing 8397 (Sibolangit) in Herb. Hort. Bot. Bog.

Other data:—

Leafy twigs stout, as in *F. apiocarpa.*

Lamina as in *F. callicarpa crassinervia*, drying toast-brown on the upper side, grey brown beneath: midrib and main veins rather deeply impressed on the upperside, strongly raised on the lower side, inarching 2.3 mm. from the edge: petiole 1.5–2.5 cm. long: stipules 12–18 mm. long, glabrous.

Receptacles with large glabrous basal bracts, 4–6 mm. long, and no internal bristles.

Gall flowers (at the receptive stage) shortly stalked, with 4–5, rarely 3, perianth-segments, free or occasionally 2 segments joined at the base.

More collections of this variety are needed, particularly of mature receptacles, to discover if there are any marked floral differences from *F. callicarpa,* because it may well prove to be a distinct species. It resembles *F. tulipifera* closely, especially in the numerous veins and perianth-segments of the gall-flower, but it has larger leaves and glabrous parts. If it proves to be a distinct species, *F. tulipifera* may be a hairy variety with small leaves, with the possibility that *F. tulipifera* represents the bathyphylls.

The leaves of this variety are like those of *F. Carri* but not so large and coarsely veined: the receptacles, too, are different. But it is noteworthy that such similar leaves should occur in both the groups of my Division 3. The leaves of *F. grandiflora* are also very similar.

F. singalana King may be the same as this variety, though it is said to have only 4 pairs of side-veins.

F. callicarpa var. **angustifolia** var. nov.

Text-Figs. 12, 13, 33.

Lamina ut in *F. punctata,* 2.4–6.8 × .9–2.3 cm, anguste oblongo-elliptica vel subobovata, coriacea, symmetrica vel sæpe subfalcata, apice obtusa, basi attenuata, sæpe asymmetrica: costæ tenues, haud vel vix prominentes.

Receptacula cecidiophora saepe maxima (corpore 10–14 × 7.5–10 cm., pariete 1.2–1.7 cm. crasso), viridia dein *obscure aurantiaca* vel rubescentia vel rubro-brunnea, *maculata papillis pallidis* 1–3 mm. latis *subprominentibus, ostiolis valde depressis* (5–7 mm.) : *receptacula feminea minora* (corpore usque 7.5 × 5 cm.), pallide maculata vix vel haud papillata, maculis 1–3 mm. latis, *laeta aurantia dein rubro-aurantia vel laete rubrobrunnea,* ostiolis 4–5 mm. depressis.

Distr. Malaya (common in the mountains of the main range), B.N. Borneo, Philippines (Luzon).

Typus:—S.F. No. 32969.

Collections:—
MALAYA:—
Nur 32969, Cameron Highlands, Pahang, ca. 1200 m., 2.5.37: gall-figs.
M. R. Henderson 23487, Cameron Highlands ca. 1500 m., 9.4.30: gall-figs.
Corner 33230 Fraser's Hill, Pahang, ca. 1200 m., 17.8.37, seed-figs: 33239, ibid., 19.8.37, gall-figs: 33242, ibid., 19.8.37, seed-figs: 33246, ibid., 20.8.37, seed-figs.
BORNEO: J. and M. S. Clemens 29315, Mt. Kinabalu, Tenompok, ca. 1600 m., 20.4.32: seed-figs (very young).
PHILIPPINES: G. Edâno 75892, Kamugong R., Camarines, Luzon, ca. 500 m., Oct. 1928 (det. *F. megacarpa*) : seed-figs.

Other data:—

Male flowers 18–24 mm. long overall, long-stalked: *perianth* 2–2.5 mm. long, gamophyllous for ½–2/3 its length, with 3, rarely 2 or 4, lobes, wine-red: *stamen* 5–7 mm. long overall, the cream yellow anther 2–2.5 mm. long and far exsert.

Gall-flowers 4.5–15 mm. long overall, sessile or with a stalk 0–5 mm. long: *perianth* composed of 3–4, rarely 1, 2, or 5, linear, wine-red pieces separately and simply attached, 4–7 mm. long: *ovary* 2 mm. wide, sessile or with a stalk up to 6 mm. long: style 1.5–1.8 mm. long.

Female and *neuter flowers* 4–6 mm. high.

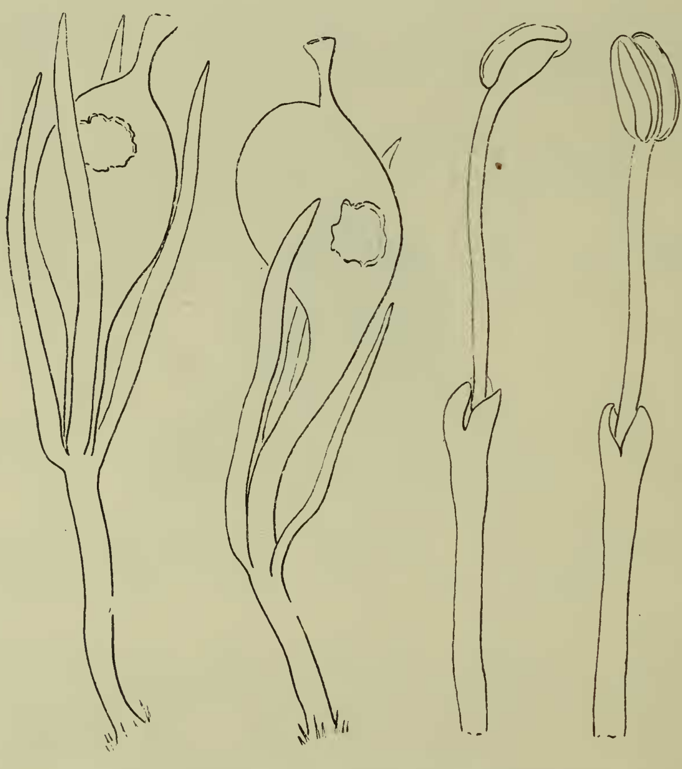


Text-Fig. 12 *F. callicarpa* var. *angustifolia:* section through a mature gall-receptacle (type-collection), × 2.

This variety is remarkable because it connects *F. callicarpa* with *F. punctata* and indeed it might well be made a glabrous variety of *F. punctata* because it differs from this species solely in its glabrous figs. It has small oblong subfalcate leaves with asymmetric base which are typical of *F. punctata,* though they are often a little larger and in the surface-structure of the fig it seems to be closer to *F.*

punctata than *F. callicarpa* despite the lack of hairs. It might even be made a new species on account of the very large, glabrous, papillate gall-figs. with their deeply sunken orifice and sombre colouring, but the seed-figs have the normal size, bright colour and pale innate or scarcely prominent spots typical of *F. callicarpa.* Moreover, the Trengganu-collection S.F. No. 33489, with leaves typical of *F. callicarpa,* has gall-figs similar in size and colour to those of *F. callicarpa angustifolia.* It is such cross-connection which makes the classification of the species into subdivisions so difficult, if not impossible, with our present imperfect knowledge. The variety *angustifolia* may well be a self-perpetuating hybrid between *F. callicarpa parvifolia* and *F. punctata.*

Between the gall- and seed-figs of this variety there is a distinct dimorphism both in size and colour, the gall-figs being much larger and more sombre, being equalled in size, in fact, only by those of *F. tawaensis.* I was able recently



Text-Fig. 13 *F. callicarpa* var *angustifolia:* gall- and male flowers, × 10.

to satisfy myself about this point at Fraser's Hill, Pahang, by means of my collecting monkey Merah (*Macacus nemestrina*). The variety is common in the hill-forest about 4,000 ft. and my monkey enjoyed itself by throwing down abundant figs from fourteen plants which we found fertile, five being gall-plants and the rest seed-plants. As I have remarked in the introduction, I believe such dimorphism is general in Synœcia though in few other cases so pronounced.

F. Carri nov. spec.

Text-Figs. 14, 15, 16, 36.

Lamina 10.5–21 × 4.8–9 cm., elliptica, elliptico-lanceolata vel ovato-lanceolata, sæpe paullum inæquilateralis et subfalcata, *coriacissima,* margine valde incurvata, apice acuminato triangulo .8–1.6 cm. longo, basi plus minus attenuata, *costa subtus valde prominenti, costis lateralibus utrinsecus* 6–10, *subtus valde prominentibus,* basalibus 3–6, *areolis piloso-foveolatis:* petiolus 2.5–4.5 cm. longus.

Receptaculum cauliflorum, vel axillare, ellipsoideum, 4–5 cm. crassum, *albo-villosum pilis subrigidis* .5–1.5 mm. longis, *ostiolo immerso: flores magni,* masculi 18–22 mm. longi, cecidiophori usque 13 mm. longi, feminei usque 11.5 mm. longi, *neutri variabiles* 4.2–9 mm. longi, cecidiophori et feminei sessiles sed ovario stipitato: *flores feminei stigmatibus indivisis vel 2–3 fissis, variabiles.*

Distr. British North Borneo, Mt. Kinabalu, 1200–1700 m. alt.

Typus: Sing. F. No. 27839, leg. C. E. Carr, Bundu Tuhan, 1500 m., 21.7.33, (gall): spec. typ. in Herb. Sing.

Paratypus: S.F. No. 26699, Menetendok-Kinataki divide, 1200 m., leg. C.E.Carr, 22.3.33 (female): J. and M. S. Clemens 29666, Tenompok, 1700 m., 10.5.32 (gall), quoad spec. in Herb. Sing.

Large root-climber with greyish white woody stems up to 2 cm. thick, with small slightly transverse pustulate lenticels: leafy twigs rather lax, stout.

Mature vegetative shoots mostly glabrous: stipules and twigs finely adpressedly puberulous, the twigs soon glabrous: *the underside of the lamina sparsely hairy with lax flexuous erect white hairs* 1–2 mm. long: the petiole and upperside of the leaf glabrous: *peduncles and receptacles thickly velvety with rather stiff white hairs* .5–1.5 mm. long.

Leaves alternate: *lamina* 10.5–21 × 4.8–9 cm., *large,* narrowly elliptic to elliptic lanceolate or ovate lanceolate, generally slightly inequilateral and curved, thick, *very coriaceous,* in the living state dark olive green above, pale green beneath with darker reticulation, *drying fawn-brown or brownish buff on both sides with the veins darker brown*

beneath, the veins strongly raised beneath, sunk in fine grooves on the upperside: edge strongly incurved (in dried leaves), generally minutely denticulate towards the apex or faintly serrulate, in some cases almost entire: *apex generally rather suddenly contracted and acuminate with a subacute, stout, triangular tip* .8–1.6 cm. long, not retuse: *base* of lamina gradually or rather suddenly narrowed, in a few cases equal and cuneate, generally distinctly but slightly inequilateral and narrowly subcordate on one side, not auricled (in one leaf broadly truncate-subcordate and slightly inequilateral) : *midrib very stout and strong right to the tip on the underside: primary lateral veins* 6–10 pairs, arising at an angle of 65–80° from the midrib, incurving near the margin and *connected by a strong arching marginal vein* looping at 1.5–2 mm. from the edge, on the underside finely longitudinally rugulose as the midrib: *secondary veins* as fine grooves on the upperside, distinctly raised on the lowerside, reticulate: *tertiary veins* mostly as fine grooves on the upperside, scarcely raised on the underside, rather broad, *reticulate with rather large hairy pits in the meshes,* in many cases the reticulations finely brown-dotted: *basal veins* 3–6, variable: *petiole* 2.5–4.8 cm. long, .25–.35 cm. wide, stout, finely brown-scurfy flaky then glabrous, finely rugulose, blackish brown (dried) : *stipules* 8–15 mm. long, lanceolate.

Bathyphylls?

Receptacles on short woody bracteate tubercles or in the axils of the leaves, singly or in pairs: *peduncle* 2–3 mm. long, 5.5 mm. wide, short stout, hairy as the body: *basal bracts* 3, 3–4 mm. long, triangular, subacute with broad slightly overlapping bases, finely adpressedly pubescent, spreading in the dried specimens but evidently adpressed in the living (i.e. alc. spec.) : *body* up to 7.5 × 5 cm., ellipsoid, barrel-shaped, not umbonate, with a distinct neck 10–14 × 5 mm., *wholly white villous with very crowded rather stiff white hairs* up to 1.5 mm. long, *green turning olive-brown then brownish purple and white hairy: orifice* 2–3 mm. wide, *deeply sunken* to 4 mm. at the bottom of a narrow pit opening by 5 grooves at the surface, apical bracts invisible from above: *internal bristles* rather scarce, up to 1 mm. long.

Male flowers 18–22 mm. long (when straightened), *very long:* pedicel flexuous, often much curved, white: *perianth* 1.6–2 mm. long, *wine-red,* subgelatinous, *gamophyllous for a half to two thirds of its length,* with subacute lobes: stamen 1, 5–6 mm. long, the anther 1.5 mm. long.

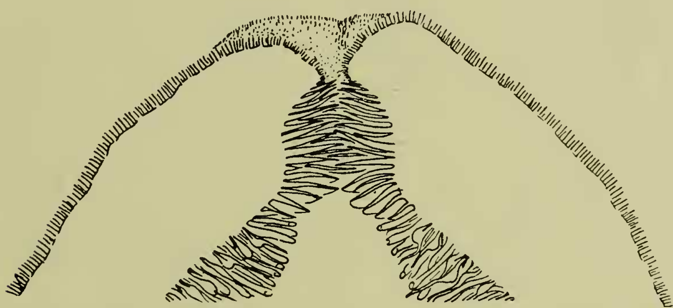
Gall-flowers 3.5–13 mm. long, *sessile: perianth* of 3–5 segments, mostly 3–4, *wine-red,* subgelatinous, entire, *free or generally 2–3 joined at the base,* occasionally joined for

some distance so as to appear as a single 2–3–fid segment, not forming a gamophyllous cup: *ovary* sessile or with a stalk up to 9.5 mm. long, glabrous: *style* 1 mm. long with a serrulate stigma.

Female flowers 6–11.5 mm. long, *sessile: perianth* of 3–4 segments, 1.5–2.3 mm. long, as in the gall-flowers but free, simply attached: *ovary* with a short or long stalk, 1–7 mm. long,: *style* 2.5–3.8 mm. long, generally with 2 arms, one long up to 1.2 mm. long, the other shorter, mostly much shorter and in many cases reduced to a tooth or even absent especially from the shorter flowers, in some cases the arms subequal, in a few cases with a short third arm.

Neuter flowers 4.2–9 mm. long, stalked, abundant, scattered among the female flowers, *very variable in height: perianth* 2 mm. long, as in the male flowers.

Seeds 2 mm. long, 1.2–1.4 mm. wide, pale brownish, smooth, ovoid slightly flattened, without a flange (but ? if normal: all the seeds empty though apparently normally developed).

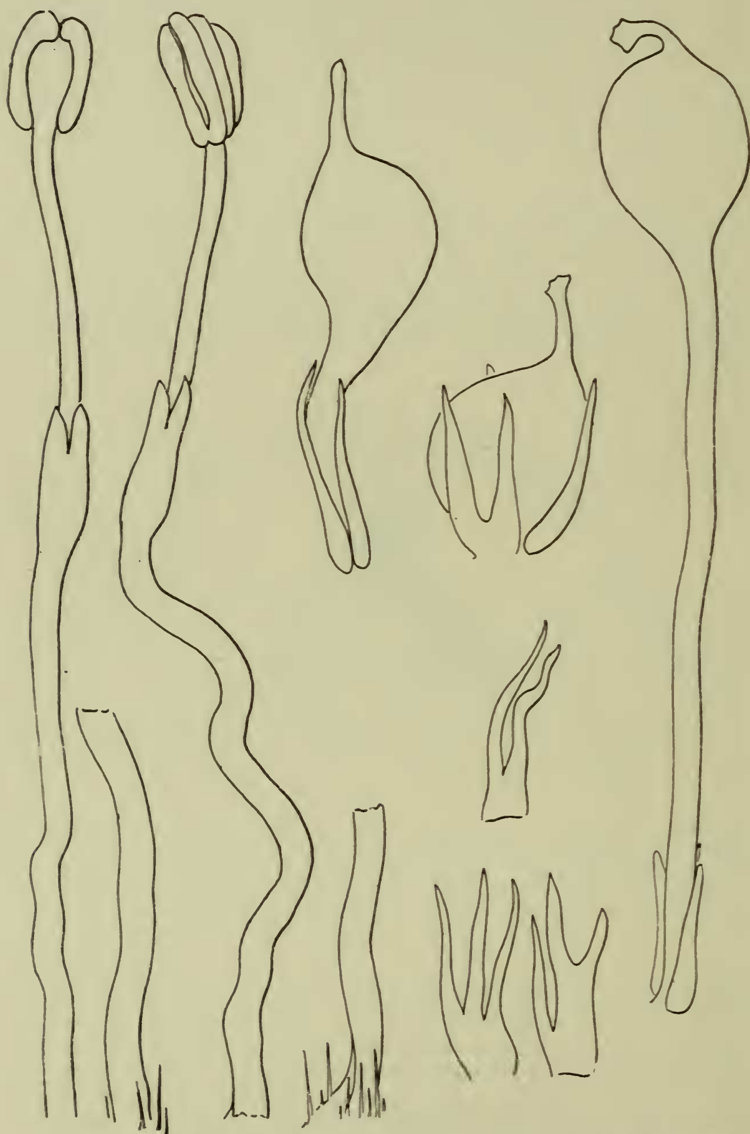


Text-Fig. 14 *F. Carri:* section through a seed-receptacle, × 2.

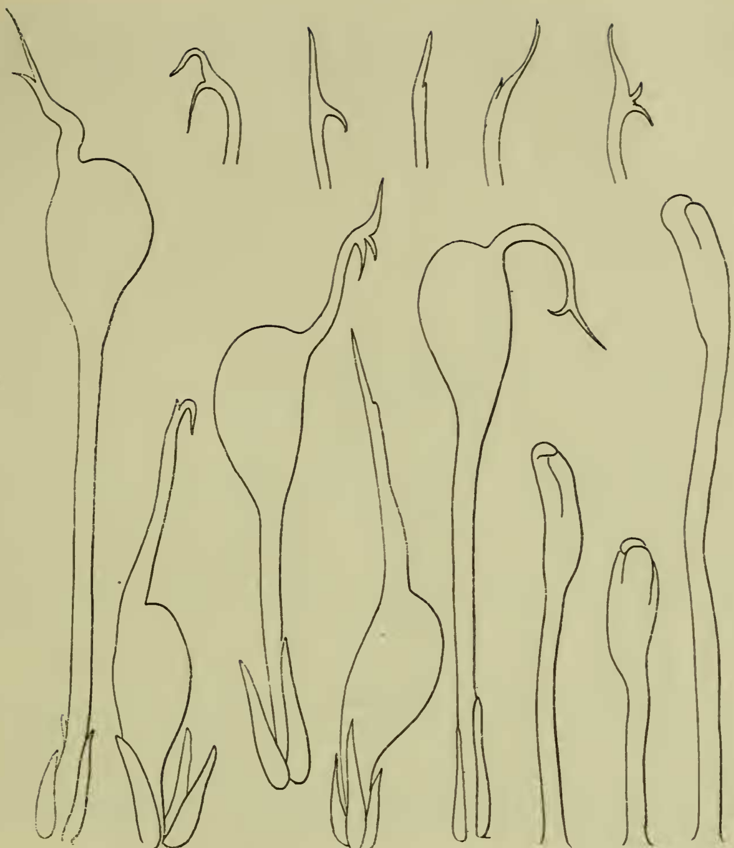
The large stiff leaves with prominent veins and the white-hairy figs render this one of the most striking species of Synœcia that has been discovered. It is easily distinguished by the large acuminate leaves drying fawn-brown, the coarse venation, the wholly villous receptacle with sunken orifice, the very long male and gall-flowers, the neuter flowers of variable length (some much shorter than the female, others nearly as long) and the variability of the female stigma. If the seeds are without flanges, as I have described, they are also distinctive but I am not certain that they may not have been abnormal because all were empty. Strangely, too, all the gall-flowers were empty, though the stamens were clearly full-grown and both seed- and gall-figs were mature with softened wall. It seems that the

receptacles develop fully even though unvisited by the wasps.

The leaves of *F. callicarpa multinervia* approach those of *F. Carri* but are neither so large nor so coarsely veined.



Text-Fig. 15 *F. Carri:* mature gall- and male flowers from the type-collection, × 10.



Text-Fig. 16 *F. Carri:* mature female and neuter flowers, with variously shaped stigmata, × 10.

Ficus cataupi Elmer
Leaflets Philip. Botany IV, *1911,* p. 1251.
Text. Figs. 17, 35.

A lofty climber (evidently with the habit of *F. punctata*) : branches ashy grey, mottled, crookedly branching and form a more or less interlaced mass along the upperside of large limbs of the support: twigs rather slender.

Stipules, young twigs, petioles and leaves finely adpressedly pubescent, becoming glabrous, the mature leaves often slightly hairy on the underside of the veins and the tesselate pits bordered with a sparse fringe of hairs.

Leaves alternate: *blade* 3.7–8 × 1.5–3.6 cm, *rather narrowly elliptic to elliptic lanceolate,* equilateral or slightly

asymmetric and then generally slightly curved basiscopically, broadest at the middle, *gradually tapered to the subacute,* occasionally subacuminate, not retuse, *apex recurved in the living state, rigidly chartaceous,* drying coriaceous and brittle, *slightly scabrid on the upperside,* pale or yellowish green, *tesselately marked beneath with small deep, sparsely hairy pits the mouths fringed with short sparse stiff white hairs,* drying dull greyish greenish or pale greyish brownish with the midrib and main veins as fine, slightly sunken lines, the venules often showing as a fine sunken reticulum, on the underside drying greyish greenish or brownish, finely brown-dotted, with the midrib and main veins prominent and raised: *edge* of blade entire, distinctly incurved: *primary lateral veins* 5–7 prs. arising at angle of 60–70° from midrib, inarching near the margin with conspicuous loops, *strongly raised on the underside of dried leaves: secondary lateral veins,* from midrib, in some cases nearly as strong as the primaries: *secondary and tertiary veins* faint, reticulate, not raised beneath, enclosing the pits: *base equal and cuneate* (though the extreme base minutely cordate) *or slightly asymmetric with a rounded subcordate, basiscopic side* not auricled and not conspicuous, with 3 basal veins: *petioles* 3–9 mm. × 1 mm., becoming brown scurfy–flaky: *stipules* 4–8 mm. long, lanceolate.

Receptacles (copied from Elmer), *singly in the leaf axils,* puberulous when young, becoming glabrous: *peduncles* very short, thick; *basal bracts* short, rigid, (?caducous): *body* up to 5 × 3 cm. ellipsoid, smooth, blotched with brown, apparently purplish when ripe: "umbilicus nipple-shaped, the opening small and circular" (Elmer): internal bristles minute, sparse.

Male flowers 7–9 mm. high overall: *perianth* 1.5–1.8 mm. long, gamophyllous to the middle, with 3, rarely 2, subacute segments, wine red, subgelatinous: *stamen* one, 3.5–4 mm. overall: anther (dehisced) 1.5 mm. long.

Gall flowers 3–6 mm. long overall, sessile or with a very short stalk: *perianth* of 3–4 linear entire, wine-red, subgelatinous firm pieces simply attached or subpeltate, 1.5–2.5 mm. long: *ovary* sessile or with a stalk up to 3 mm. long: ovary ca. 2 mm. wide: style .5–.9 mm. long: stigma denticulate.

Collections:—

Elmer 11822: Todayo (Mt. Apo), Davao, Mindanao, P.I. Sept. 1909: 4,500 ft.: in dense humid rigid forest, (*Type Collection*).

Elmer 14211: Cabadbaran (Mt. Urdaneta), Agusan, Mindanao Oct. 1912. (Duplicates in Herb. Bot. Bog. also examined, at the same time).

Female and neuter flowers of this species are not known and it seems that there is much to be learnt still about the receptacles, whether for instance they are always in the leaf-axils.



Text-Fig. 17 *F. cataupi:* mature gall- and male flowers, with two immature gall-flowers, from the type-collection: × 10.



Text-Fig. 18 *F. dens-echini:* section through the orifice of a seed-receptacle of the type-collection, × 2: the orifice × 3.

I do not agree with Elmer's description of the flowers: the male flowers are not subtended by bracts; the gall-flowers have the typical Synœcia-perianth; and there is no tube encircling the stalk of the gall-flower. Nor can I agree with that author that the species is allied to *F. apiocarpa,* except remotely. It has slender twigs, the habit of *F. callicarpa,* small leaves with stomatal pits, short petioles and a different perianth so that it is clearly related to *F. callicarpa* and I expect that it has bathyphylls and marbled receptacles. *F. cataupi* is, indeed, so close to *F. callicarpa crassinervia* that the only distinguishing features that I can find in the former are the tapered acute, not retuse, apex of the leaf, the slightly more numerous side-veins, the slightly scabrid upperside of the blade, the hairiness of the stomatal pits and, perhaps, the axillary position of the receptacles, and the attachment of the sepals. None of these are points of great moment. A long series of specimens is needed before the position of such a species can be estimated.

F. barba-jovis has similar but much more asymmetric, acuminate leaves and different receptacles. Compare also *F. tulipifera* and *F. trachycoma.*

F. dens-echini nov. sp.

Text-Figs. 18, 19, 36.

F. apiocarpae similis: *lamina* 12–18 × 7.3–10.5 cm., *ovata,* medio vel basim versus latissima, equalis, subcoriacea, *apice acuminata* (5–13 mm. longa), *basi late cordata* haud profunde, *costis lateralibus utrinsecus* 4–8 subtus prominentibus, costis basalibus 3–5, *areolis minute piloso-foveolata: petiolus* 4–10 cm. *longus.*

Receptaculum axillare, ellipsoideum, 6 cm. latum, *valde umbonatum, glabrum, bractis apicalibus 5 crassis nitidis umbonatis praeditum:* setis internis deficientibus: *flores feminei* usque 16 mm. alti, *longe pedicellati, ovario sessili, perianthii segmentis* 4–5, raro 6–7, vix incrassatis, purpureis: *flores neutri* perianthii segmentis 4 plus minus liberis.

Distr. B. N. Borneo, Mt. Kinabalu.

Typus:—S.F. No. 26807 (C. E. Carr, 29.3.33).

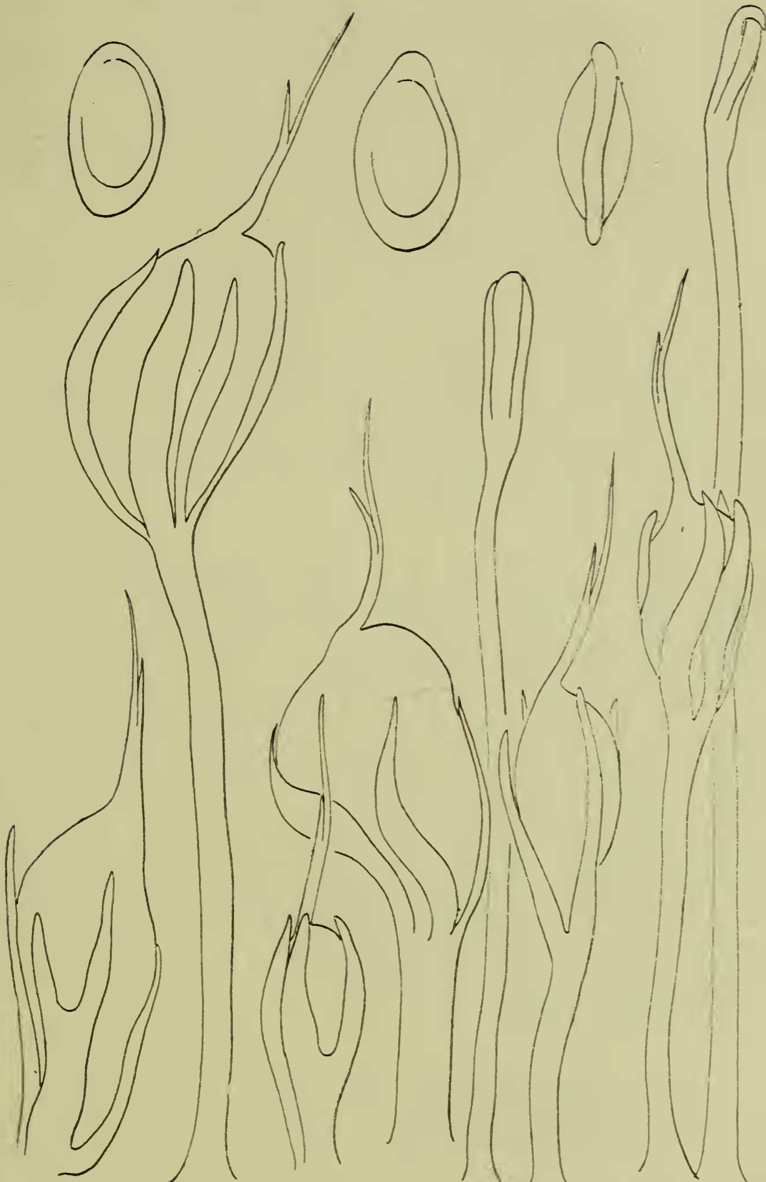
Collections:—

Carr 26807, Kinataki R., ca. 1200 m., 29.3.33: seed-figs.

Clemens 27199, Dallas, ca. 1000 m., 30.11.31 (leaves only).

Clemens 29352, Tenompok, ca, 1600 m., 20.4.32: seed-figs.

A large root-climber: stem reaching at least 1 cm. thick: twigs hollow.



Text-Fig. 19 *F. dens-echini:* mature female and neuter flowers with seeds from the type-collection: × 10.

The young parts minutely and sparsely puberulous: mature parts glabrous except the stomatal pits.

Leaf-blade 12–18 × 7.3–10.5 cm., *ovate,* broadest at or below the middle, *symmetrical, shortly and rather abruptly acuminate,* with a subacute tip 5–13 mm. long, *the base shallowly and broadly cordate, symmetrical,* edge entire and somewhat incurved, 'fleshy' (Carr's field-note), drying pale fawn or greyish on the upperside deeper fawn brown beneath with the main veins showing as fine slightly raised lines on the upper surface: *primary lateral veins* 4–8 pairs, arising at an angle of 70–90° from the midrib, distinctly arching at the margin, prominent beneath in the dried leaf, faint above: *secondary veins* reticulate: *tertiary veins* enclosing square or oblong areolae tesselate *with minute hairy stomatal pits,* finely tuberculate along the veinlets in the dried leaf: *basal veins* 3–5, the main lateral ones making an angle of 60–70° with the median: *petiole* 4–10 cm. *long,* 2.5–4 mm. wide, becoming brown scurfy: *stipules* 15–45 mm. long, broadly lanceolate.

Bathyphylls?

Receptacles axillary or on rudimentary leafless twigs on the old stems, singly or in pairs, *ripening dark brown with paler speckling: peduncles* 2–5 mm. long, 7–11 mm. wide, *very short and thick: basal bracts* 3, 3–4 mm. long, broad, obtuse, membranous, glabrous: neck 2.5–3.5 × .6–.8 cm. pronounced: *body* 7 × 6 cm., ellipsoid, not pyriform, *with a broad apical umbo* 2.5 cm. wide and .6 cm. high: *orifice* 6–7 mm. wide, scarcely prominent, not sunken, *entirely closed by 5 large, thick, shining, umbonate, apical bracts: internal bristles* absent.

Female flowers 6.5–16 mm. long overall, *tall,* sessile or stalked: *pedicel* slender, glabrous, up to 9 mm. long: *perianth* of 4–5, rarely 6 or 7, lanceolate, subacute or acute, thin, flat or slightly fleshy, entire, wine-red segments 2–4 mm. long, free or occasionally 2–3 joined near the base or to the middle, simply attached: *ovary sessile or subsessile: style* 3–3.5 mm. long.

Seed 2.3–2.8 mm. long, × 1.3–1.6 mm. wide, 1 mm. thick.

Neuter flowers 8–16 mm. high: pedicel slender: *perianth* 2.5 mm. long with 4, rarely 3, entire, wine-red, slightly hooded segments free or narrowly joined at the base: a few with an abortive rudimentary pistil: mostly empty.

Gall- and male flowers unknown.

Unless one examines this species carefully it will be mistaken for *F. apiocarpa, F. Bordenii,* or *F. Scratchleyana.* From all it differs in possessing minute stomatal pits,

distinctly and broadly cordate leaves with long stalks, a sessile ovary in the very large female flowers and five big umbonate bracts round the orifice of the fig. From this feature, which suggests "Aristotle's Lantern" in oral view, I give the specific epithet. The leaves resemble in an extraordinary degree those of some climbing species of Eusyce collected by Mr. Carr in Papua. The brown colour of the ripe figs recalls *F. Bordenii.* At maturity the pedicels and ovary-walls become glued together so that the flowers are difficult or impossible to separate, but the perianth-segments remain free and entire; they are never reticulate-dentate as in *F. apiocarpa.*

The receptacle which Mr. Carr preserved in spirit has an uneven and strongly rugose surface but whether naturally so when fresh or because it was partly dried or has shrunk in spirit, I do not know.

The sheet of Clemens 27199 in the Singapore Herbarium has the leaves of *F. dens-echini* and a part of a receptacle which probably belongs to *F. callicarpa parvifolia.*

√**F. grandiflora** nov. sp.

Text-Figs. 20, 21.

F. callicarpae affinis: *lamina* 10–16.5 × 4.2–7 cm., *elliptica,* saepe anguste, *utrinque attenuata, apice acuta,* subcoriacea, *aequalis vel vix falcata, costis lateralibus utrinsecus* 6–9, vix prominentibus, basalibus 3, *areolis piloso-foveolatis:* petiolus 12–20 mm. longus.

Receptaculum ut in *F. callicarpa,* 6–7 cm. latum: *flores magni, pedicellis crassis:* flores masculi 20–25 mm. longi, pedicello 1 mm. crasso: *flores cecidiophori* 6–17 mm. longi, pedicello 1–2 mm. crasso, *perianthii segmentis* 4–6, *plerumque* 5, simpliciter adnexis, *crassis,* gelatinosis, purpureis *liberis vel plerumque 2–3 connexis vel omnino breviter connexis ovario sessili amplectantibus.*

Distr. Brit. N. Borneo, Mt. Kinabalu.

Typus. Clemens 30290, Dallas, ca. 1000 m., 2.12.31 (specimen in Herb. Hort. Sing.).

Paratypus. Clemens 27139, ibid., 1.11.31 (leaves only: receptacles of another species).

Apparently with the habit of *F. callicarpa.*

Wholly glabrous except for the hairy stomatal pits on the underside of the leaf and the internal bristles of the receptacle.

Bathyphylls?

Leaf-blade 10–16.5 × 4.2–7 cm., *elliptic, often narrowly, tapered gradually to each end,* equilateral or slightly curved and asymmetric, the apex subacuminate, the base narrowly cuneate, edges entire but incurled when dried, thinly coriacous, *densely and rather coarsely foveolate on the*

underside with hairy stomatal pits, drying greenish brownish to fawn-brown on both sides, not scabrid; *primary lateral veins* 6–9 pairs, making an angle of ca. 65° with the midrib, inarching near the margin, as fine raised lines on the upperside of the dried leaf, more distinctly raised beneath but not prominent: *secondary and tertiary veins* distinct but not raised: *basal veins* 3: *petiole* 12–20 × 1.5–2 mm., becoming brown flaky: *stipules* 10–17 mm. long.

Receptacles evidently as in *F. callicarpa,* large glabrous, red and marbled, arising from the creeping main stems, 6–7 mm. wide.

Male flowers 20–25 mm. long overall, very numerous, *with very stout flexuous white stalks* 1 mm. thick: *perianth* 3–4 mm. long, wine-red, *with* 3–4, rarely 2, *lanceolate lobes united for* 1/3–½ *their length: stamen* 3.5–4.5 mm. long overall, the anther 2.5 mm. long, not exsert (but ? full-grown).

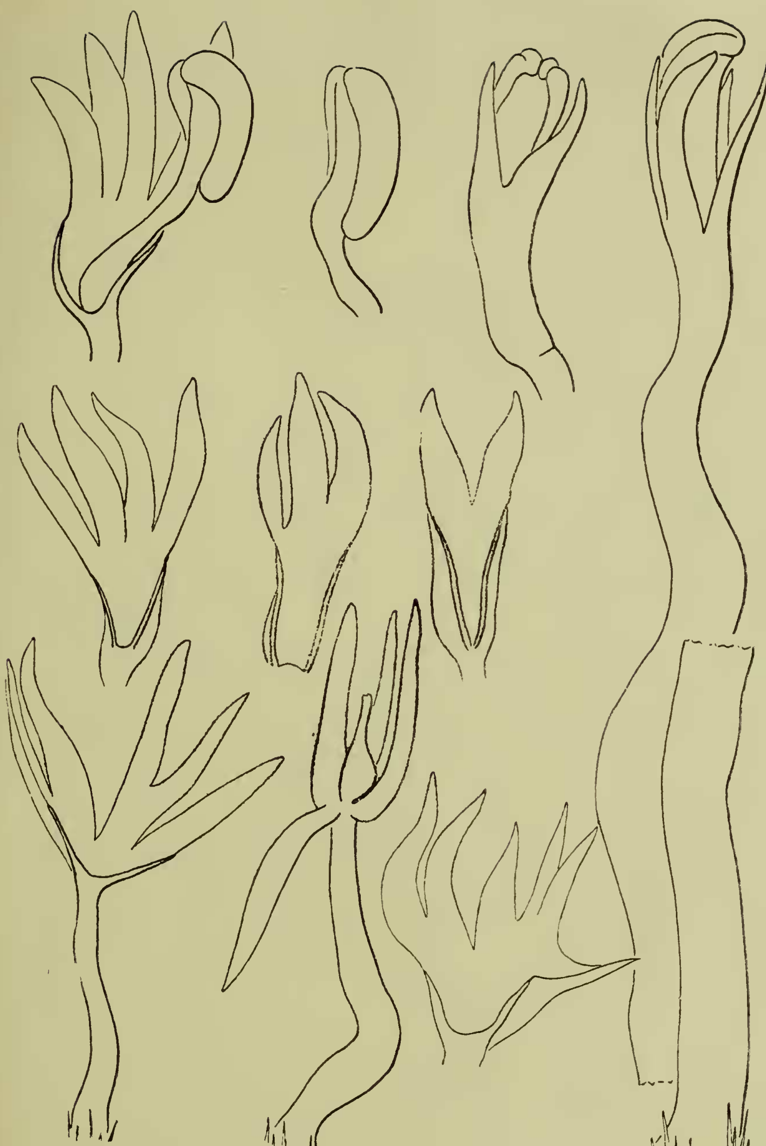
Gall-flowers 6–17 mm. long overall, crowded among the male flowers, many undeveloped, *with very stout, flexuous, white stalks* 2–3 mm. long, 1–2 mm. thick: *perianth composed of* 4–6, mostly 5, *lanceolate, thick, stout, gelatinous, wine-red segments* 2–4 mm. long, *free or commonly* 2–3 *united for* ¼–2/3 *their length, or all united for* ¼ *their length into a shallow gamophyllous cup: ovary sessile,* 2–2.5 mm. wide, *clasped by the coarse sepals,* the style tiny, .6–.8 mm. long.

This species is distinguished from all others in the subgenus by its very large, stoutly stalked flowers, its coarse perianth-segments that are rather more numerous than usual and by the sessile ovary of the gall-flower. The other species of Synœcia have filamentous pedicels .2–.6 mm. wide (1–2 mm. wide in *F. grandiflora*) and the ovary in their gall-flowers is commonly stalked so as to raise it above the level of attachment of the perianth. The flowers of *F. grandiflora* must be well-nigh the biggest in the genus.

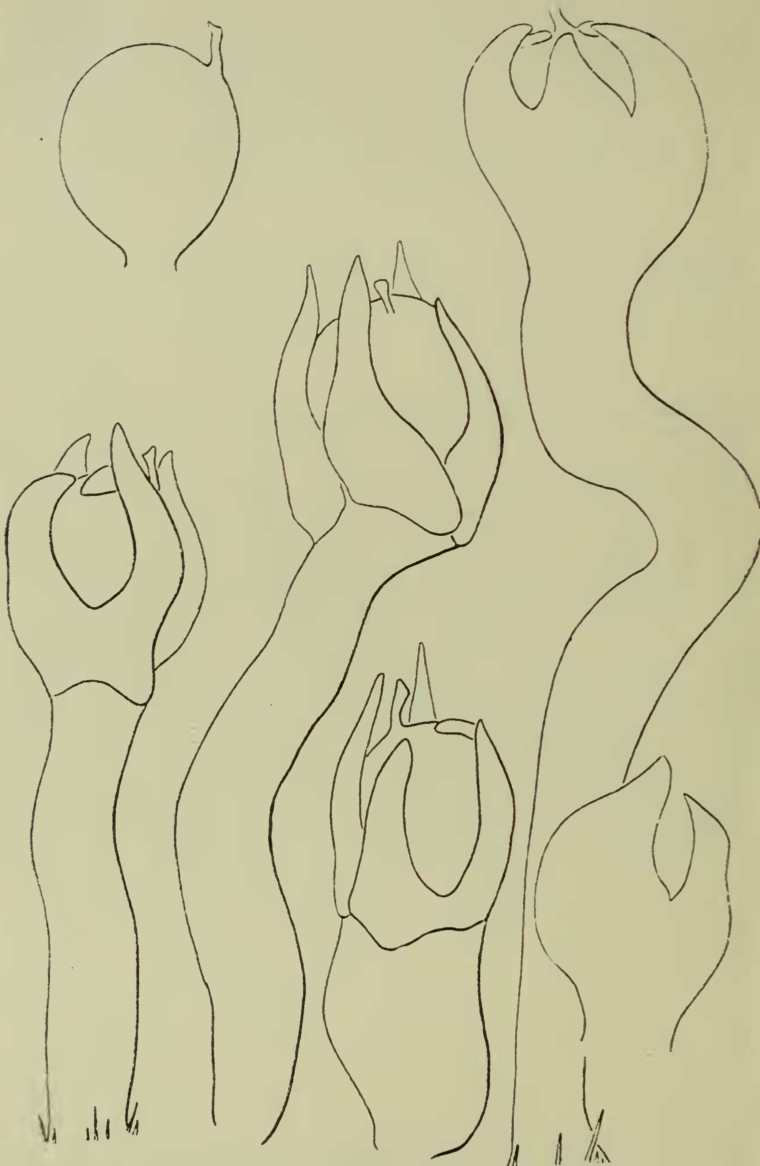
F. dens-echini approaches *F. grandiflora* in the sessile ovary of its female flowers and I think that the two may be allied. *F. tulipifera* also has rather coarse sepals and clumsy flowers but it has much smaller figs, flowers and leaves and its gall-flowers are sessile with a stalked ovary.

In leaf *F. grandiflora* resembles *F. callicarpa multinervia* but the veins are not impressed above nor are they so strong beneath.

The collection Clemens 27139 is mixed, at least the sheet in the Singapore herbarium, for it bears the leafy twig of *F. grandiflora* and both a gall- and a seed-fig (!) of what is probably *F. callicarpa parvifolia.* Hence my limitation of the type-collection to the specimen which I have seen at Singapore.



Text-Fig. 20 *F. grandiflora:* mature male flowers and (bottom left) 2 undeveloped gall-flowers with a perianth cut-open, from the type-collection: × 10.



Text-Fig. 21 *F. grandiflora:* mature gall-flowers from the type-collection: × 10.

Ficus punctata Thunb.

Text Figs. 8, 22–25, 33.

Stipules, twigs and petioles finely adpressedly hairy, the twigs and petioles slowly glabrescent: occasionally with the hairs rather spreading, receptacles closely velvety-hairy.

Lamina 1.5–4.7 × .6–2.5 cm., *rather small, linear-oblong to lanceolate-obovate or elliptic-obovate, generally rather narrow and gradually narrowed to the base, more or less distinctly inequilateral and subfalcate,* rarely equilateral, coriaceous, glabrous, shining green above, pale green and *tesselate beneath with minute white hairy stomatal pits* in the areolae, drying pale dirty greyish green or greyish yellowish on both sides, or slightly brownish on the underside: *edges* entire, slightly incurved: *apex blunt,* retuse, rarely tapered and subacute-retuse: *primary lateral veins* 3–5 pairs, distinctly inarching near the margin, in dried leaves slightly raised on the underside, hardly visible on the upperside: *secondary lat. veins* faint, scarcely raised: *tertiary lat. veins* not raised, fine, enclosing the stomatal pits: *base attenuate, generally more or less distinctly asymmetric, the broader side subcordate,* rarely symmetric, not auricled, with 3–5 basal veins, the lateral ones faint: *petiole* 1.5–9 mm. long, 1 mm. wide, slender, becoming brown scurfy-flaky: *stipules* 2–7 mm. long, lanceolate, fairly persistent.

Bathyphylls: lamina 4–8 × 1.5–6 mm., like the mature leaves but smaller, often elliptic-lanceolate, always strongly asymmetric and falcate, the acroscopic side often very narrow or reduced to a wing: the youngest bathyphylls on seedling plants without stomatal pits.

Receptacles cauliflorous on woody, stipulate tubercles up to 3.5 cm. long on the main stem or the bases of the larger side-branches, hanging: *peduncle* up to 2 cm. long, or absent, stout, finely white puberulous: *basal bracts* 3, 3–4 mm. long, broadly triangular, acute, adressedly puberulous like the stipules: *body* 5–11 × 4–8 cm., *globoso-pyriform with a broad low umbo* ca. 17 mm. wide × 3 mm. high, *finely velvety hispid* with short white bristles, *faintly papillate over the whole surface with scattered large blunt papillae* ca. 1 mm. wide and placed 2–10 mm. apart, the intervals between them beset with the hairs and tiny crowded often contiguous papillae or irregular processes giving a rugulose appearance (like the surface of a powdery Lycoperdon), *peach-pink, not marbled: neck* .4–2 cm. long: *orifice* 4 mm. wide, in a shallow depression in the umbo, surrounded by the small inconspicuous apical bracts and closed by the broader internal bracts: *internal bristles* abundant, seldom scarce or even absent.

Male flowers 9–15 mm. long: pedicel white, glabrous: *perianth* 1–2 mm. long,wine-red, tubular for half its length, with 3, rarely 2, thick, subgelatinous lobes: *stamen* 3–5.5 mm. long, anther 1.5–1.8 mm. long and fully exsert.

Gall-flowers 3.5–8.5 mm. long, sessile or with a stalk up to 2 mm. long: *perianth* of 0–3 segments, generally 1–2, free, linear, entire subgelatinous, wine-red, 2–5 mm. long, with simply attached base: *ovary* 1.2–2.2 mm. wide, sessile or with a stalk up to 4 mm. long: *style* .7–1.5 mm. long: stigma distinctly denticulate.



Text-Fig. 22 *F. punctata:* section through the orifice of a full-grown gall-receptacle, × 2: orifice × 3, (Henderson 29669, Malaya).

Female flowers 3.5–6 mm. long, sessile or substipitate: *perianth* as in the gall-flowers but the segments shorter, 1–3 mm. long: *ovary* .8–.9 mm. wide, sessile or with a stalk up to 2.5 mm. long: *style* slender glabrous, 1.8–3.4 mm. long: *stigma* with slender, unequal arms, the longer .7–1.2 mm. long, occasionally subequal.

Neuter flowers 4–5.5 mm. long, stalked: *perianth* 1.5–1.8 mm. long, gamophyllous to the middle with 3 segments, one more or less hooded over the others, wine-red, subgelatinous, thick, in some cases enclosing a sterile rod.

Seeds 1.6–2 mm. long, pale straw-colour, smooth, hard, flattened and keeled.

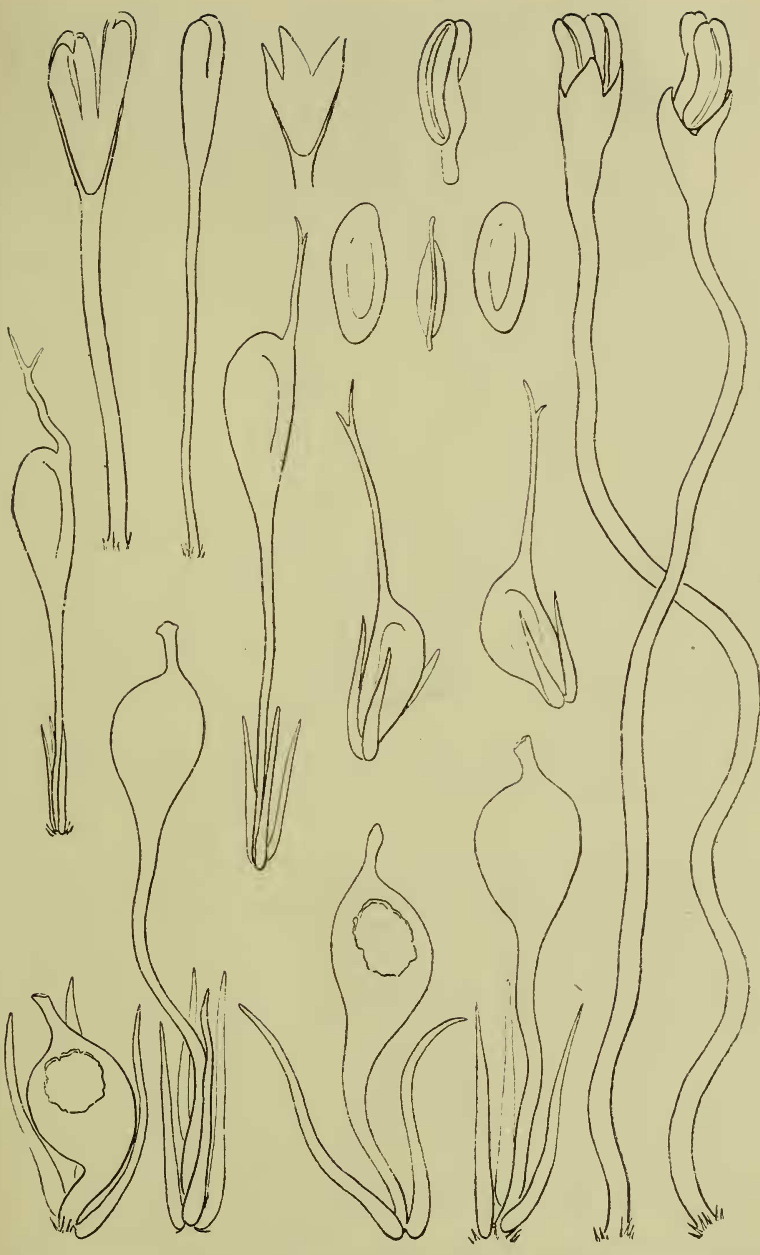
Habitat:—in high forest in plains and mountains to an altitude of 1500 m., also in villages and orchards.

Distribution.—Java, Sumatra, Malaya, S.E. Borneo.

Collections:—

BORNEO: Jaheri 829, S. Dengey, (Exp. Nieuwenhuis, 1896–7): H. Winkler 2357, 9.6.08.

JAVA: Backer 1682, 6173, 9426, 10117, 10561, 10916, 14058, 14203, 16287, 23851, 25468: Bakhuizen v.d. Brink 1297, 1615, 1776, 2297, 4330: Bruggeman 431: Dakkus 39:



Text-Fig. 23 *F. punctata:* mature male, neuter, gall- and female flowers and 3 seeds: × 10.

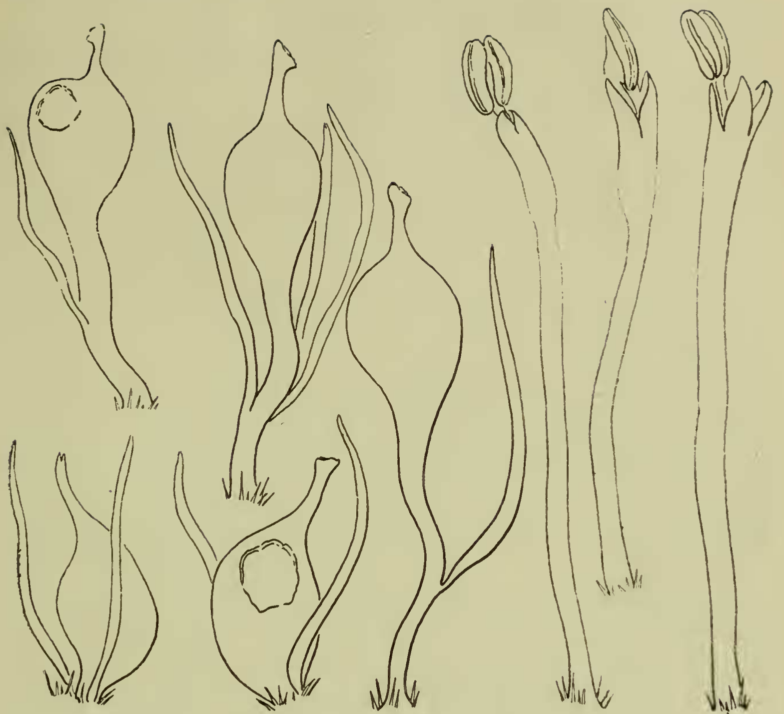
Docters v. Leeuwen s.n. 28.9.10: Forbes 257, 283, 302: Hallier s.n. 27.12.94: Herb. Hort. Bot. Bog. 6916: Hundeslagen s.n. 1921: Junghuhn 3: King s.n. 1872: Koorders 15473, 20431, 23596, 23780, 24419, 26044, 26342, 28692, 28696, 31559, 32876, 39237, 41480, 41546, 42990, 43696, 44550: Kurz 678, s.n. Hort. Bog.: de Monchy 118: Scheffer 7032: van Steenis 141, 2409, 2426, 4010: Winckel 430, 1145.

MALAYA: Foxworthy 2585: Goodenough 10542: Henderson 29669; Hume 7312, 8293, 8639: Kunstler 4278, 4828: Ridley s.n. Batu Caves: Symington 24530: (Perak, Selangor, Kelantan).

SUMATRA: Koorders s.n. Sumatra (Herb. Calc.): Lorzing 6396.



Text-Fig. 24 *F. punctata:* mature gall- and male flowers, and 2 immature gall-flowers of the collection Corner s.n. Bentong, Pahang, 30–10–32; × 10.



Text-Fig. 25 *F. punctata:* mature gall- and male flowers of the collection Foxworthy 2585 (Malaya) : × 10.

It may be that *F. callicarpa* and *F. punctata* should be united but I prefer to distinguish them until they are better known. *F. callicarpa* has glabrous, orange-red receptacles marbled with pale, innate spots, and rather broad leaves. *F. punctata* has wholly villous, peach-pink to reddish pink receptacles, not marbled but papillate with tiny spaced lumps, and small narrow leaves. In venation, flower and seed-structure I can find no constant difference because both are very variable. The perianth of the gall-flower, however, is often more or less deficient in *F. punctata* and the segments in both gall- and female flowers seem always to be simply attached.

Against such specific distinction may be set the following facts:—

1. *F. callicarpa angustifolia* has the leaves of *F. punctata* and the receptacles of *F. callicarpa* but they are not marbled but papillate as in *F. punctata.* It

might as well be made a variety of *F. punctata* with glabrous orange-red receptacles.

2. In *F. callicarpa parvifolia* the young receptacles may be more or less villous and become glabrous only when reaching maturity.

3. Near Bentong in Pahang, I collected on the 30th October, 1932, a plant with the receptacles of *F. punctata* and the leaves of *F. callicarpa typica.* That the receptacles and leaves came off the same stem I can testify because I climbed the tree to collect the specimens. The receptacles contained gall-flowers which had 0–1 perianth segments as in certain specimens of *F. punctata* from Malaya and Java (Text Fig. 24).

F. punctata is probably an advanced state of *F. callicarpa* with persistently villous receptacles and reduced leaves, that has been evolved on the Sunda-shelf. It seems the commonest Synœcia in Java where it is remarkably constant. It is through the Javanese collections that I have been able to identify the bathyphylls. Lorzing 6396 and Winckel 430 have both receptacles and bathyphylls attached to the same woody stems. The passage from the very juvenile bathyphylls without stomatal pits to those with stomatal pits is shown by Koorders 23780 and 42990, Forbes 257, and Bakhuizen v.d. Brink 1615. Under Koorders 23780 is a sheet of a sterile twig with very hairy, symmetric, cordate leaves which possibly represents a Eusyce such as *F. repens* or *F. villosa.* Dakkus 39 has unusually broad leaves.

As in *F. callicarpa,* the male flowers vary much in length but in each collection, and presumably therefore in each plant, they are constant within normal limits, e.g.:—

Collection	*Length of Male Flower (overall) in mm.*
v. Steenis 4010	9
Winckel 430	10
Backer 14203	10–11
Bruggeman 431	11–13
Lorzing 6396	12–14
Koorders 28696	12–15

The number of perianth-segments in the gall-flowers also varies in different collections. Henderson 29669 (Malaya), Backer 14203 and Koorders 28696 have no perianth. Koorders 41480 has no perianth to some of the female flowers and no internal bristles.

The record of *F. punctata* from Indo-China must be *F. callicarpa parvifolia,* if it is a Synœcia at all.

F. Scratchleyana King
Ann. R.B.G. Calc. 2, *1888,* suppl., p. 5.

Text-Figs. 26, 36.

A climber closely resembling *F. apiocarpa.*

Young twigs and leaves finely hairy at first, soon glabrous: twigs thick.

Leaf-blade 7–20 × 4.5–9.6 cm., *broadly ovate to narrowly ovate or ovate-lanceolate,* glabrous, coriaceous, symmetrical, *the apex acuminate* with a tip .5–2 cm. long, *the base widely cuneate and rounded or almost truncate and broad,* not cordate, with entire edge, drying greyish brownish on the underside and tesselate with brownish areolæ, *without stomatal pits: primary lateral veins* 6–9 pairs, making an angle of 60–75° with the midrib, flush with the upper surface of dried leaves and slightly raised on the under surface, inarching near the margin, the arches only 1–2 mm. from the edge, without a marginal vein: *secondary veins* rather distant, more or less transverse, not raised: *tertiary reticulations* fine and distinct in dried leaves, not raised, minutely tuberculate: *basal veins* 3, *the lateral ones* making an angle of 45° with the midrib and *reaching* ¼–1/3 *the length of the blade: petioles* 2–6 × .2–.3 cm., becoming brown scurfy: *stipules* 1–2 cm. long. lanceolate, soon glabrous.

Receptacles in the leaf-axils, apparently shaped as in *F. apiocarpa* but not so large, puberulous becoming glabrous: *peduncle* 1–12 mm. long, rather slender in dried specimens: *basal bracts* 1.5–2.5 mm. long. crescentic, blunt, sparsely hairy on the back: *neck* long and pronounced in dried specimens: orifice ?: *internal bristles* abundant, .5–1 mm. long.

Male flowers 6–8 mm. overall (evidently mature, having dehisced anthers) : pedicel 3–5 mm. long: *perianth* 2.5–3.5 mm. long, *composed of 3 rather broad, separate, wine-red segments* with down-curved, hooded tips in the bud, occasionally 2 segments joined to the middle: *stamen* 3–3.5 mm. long: anther scarcely exsert.

Gall-flowers 3–6 mm. high overall, sessile or very shortly stalked.: *perianth* of 3–4 segments, 3–7 mm. long, *free,* rarely 2 joined, linear, entire, subgelatinous, simply attached, wine-red: *ovary* sessile or with a stalk up to 2 mm. long: *style* .5–.8 mm. long, with denticulate stigma.

[*Fertile female* flowers pedicellate; the perianth of 4 linear pieces; ovary ovoid-elliptic; the style lateral: stigma large, bicrural when young, truncate when adult from the absorption of the arms.

Neuter flowers mixed with the females all over the receptacle, pedicellate; the perianth of 4 lanceolate pieces. (ex King).]

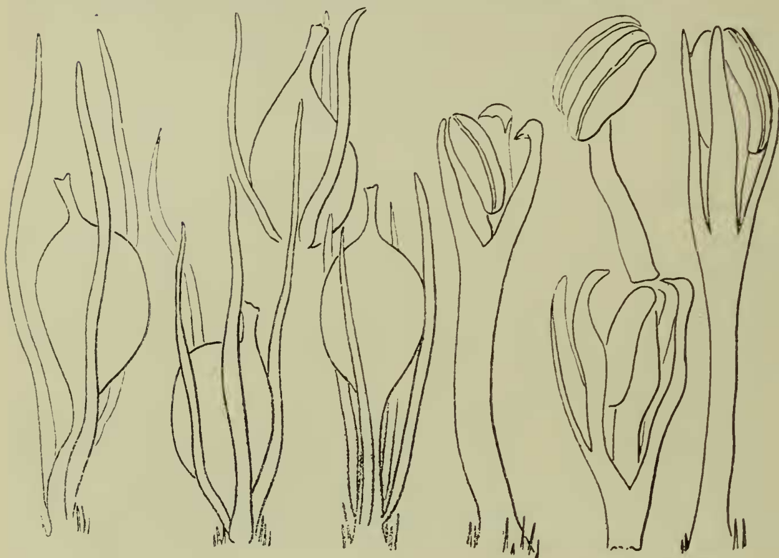
Distr. Philippines, New Guinea.

Collections:—

PHILIPPINES:—

Elmer 7445 (Lucban, Luzon): 10232 (Island of Negros): 16116 (Sorsogon, Luzon): 22156 (Mt. Pinatubo, Luzon).
Ramos 22200 (Mt. Iriga, Camarines): 23331 (Sorsogon, Luzon).
Mabesa 28055 (Batangas, Luzon).
Villamil 21382 (Mt. Maquiling, Luzon).

NEW GUINEA: H. O. Forbes 900 (Type, not seen).



Text-Fig. 26 *F. Scratchleyana:* mature gall- and male flowers (Philippine specimens): × 10.

The Philippine collections on which I have based this description (with the exception of the female and neuter flowers which have been taken from King) have been referred to *F. apiocarpa*. There is yet no evidence, however, that *F. apiocarpa* occurs in the Philippines, Elmer had, indeed, proposed the manuscript name *F. peninsula* for these specimens. My reasons for identifying them with *F. Scratchleyana* are as follows.

The type of *F. Scratchleyana* (Forbes, New Guinea) is in the British Museum. (It is doubtful if any duplicate exists, for there is none at Kew nor at Calcutta). Mr. C. E. C. Fischer kindly examined the type for me and reported that there were no hairy stomatal pits on the underside of the leaves. Reconsidering King's description in the light of this fact, I find that it corresponds very closely to these Philippine collections and to *F. Bordenii*. That it is not *F. Bordenii* I am certain from King's

description of the petiole as 1–1.5″ long (½–¾″ in *F. Bordenii*) and the leaf-blade as tapered to the base with 3 basal veins in *F. Scratchleyana.* Moreover, King's description and figure apply excellently to the Philippine "F. apiocarpa". Elmer 16116 might have been the object of King's figure except that the leaf-tip in the figure is rather short. This, indeed, is the sole discrepancy and I do not see how one can maintain two species on such a triviality.

I have purposely based my description of *F. Scratchleyana* entirely on the Philippine specimens so that, should they turn out to be another species, I shall have created no confusion except in identity. Seed-figs have not yet been collected in the Philippines.

There is no doubt that *F. Scratchleyana* is closely related to *F. apiocarpa* but it differs markedly in the venation and the perianth. It seems to be the only species of Synœcia that has reached New Guinea.

F. Simiæ Winkler

Engl. Bot. Jahrb. 49, *1913,* p. 362.

A big climber: stem 6–8 cm. thick.

Bathyphylls?

Leaf-blade 26 × 13 cm. *large, oval, rounded obtuse at base and apex,* (symmetrical), coriaceous, glabrous: *primary lateral veins 9–10 pairs,* prominent on the underside, scarcely visible above, the basal nerves 3 the areolæ *white-spotted* (? with stomatal pits).

Receptacles cauliflorous on woody branches 6–10 cm. long: *peduncle* 2 cm. long (? including the neck): *body* ca. 10 × 8 cm. with the wall 12–15 mm. thick, *yellow or red* (? marbled with paler spots), *glabrous: orifice* slightly sunken: *internal bristles present.*

Male flowers with pedicels 9–10 mm. long and dilated below the tubular, 3–partite perianth (1 mm. long): stamen with the filament 3–4 mm. long, the anther exsert.

Gall flowers sessile or stalked (? ovary stalk), always shorter than the male; perianth of 2–3–4 free, linear or subulate segments, sometimes 1–2 lobed, "fuscous with hyaline margin".

Distr. S.E. Borneo, Hayup.

Type. Winkler 2515.

This description is taken from Winkler's. I have little doubt that *F. Simiae* is another Bornean speciality of Synœcia but it is unwise to regard it as a scientific fact until it has been discovered again. It was described from a stem with receptacles and one fallen leaf, the connection of which with the rest of the plant was not ascertained but merely surmised from its white tesselate lower surface and from the absence of other species of Ficus in the vicinity.

It seems to be a variety of *F. callicarpa* with big leaves and thus to suggest that the big-leafed ancestor of *F. callicarpa* also evolved in Borneo, whence the species has spread.

Ficus singalana King.

Ann. Roy. Bot. Gard. Calc. 2, *1888*, p. 70.

I think this is my *F. callicarpa multinervia.* I have seen no specimen of *F. singalana,* but from King's description and figure I do not see how to distinguish it specifically from *F. callicarpa.* King was not aware of the extraordinary variability of *F. callicarpa* and the manner in which its leaves grade into those of *F. punctata.*

F. tawænsis Merrill

Univ. Calif. Publ. Bot. 15. *1929,* p. 48.

Text-Figs. 27, 35.

A tall, strong root-climber, the main stem up to 15 cm. wide, dull brown (dried), coarsely lenticellate.

Twigs, petioles and stipules closely pilose with rather short, subferruginous (dried) hairs, adpressed on the stipules, villous on the other parts, the twigs ultimately glabrous: *leaf-blade when young densely villous with whitish hairs,* becoming subglabrous on the upperside but scabrid from the persistent, papillate hair-bases, *on the lower side persistently hairy* especially along the veins.

Leaf-blade 2.5–7 × 1.4–3.3 cm., *elliptic or narrowly ovate-elliptic, symmetrical with the base broadly cordate and with a rather deep sinus between the lobes, the apex rounded or subacute,* not retuse or acuminate, subcoriaceous, the edge entire, dark green above, much paler beneath, drying dull grey or greyish brown on the upperside with the main veins distinct but not raised or sunken and the reticulate veins as very slightly raised, fine lines, on the underside paler greenish grey with the midrib and main veins prominent and raised: *primary lateral veins* 3–5 pairs, making an angle of ca. 50° with the midrib, inarching near the margin but without a distinct marginal vein, slightly raised beneath in dried leaves: *secondary and tertiary veins* reticulate, not or scarcely raised, fine but distinct, with pale brown spots in the reticulations, *without stomatal pits: basal veins* 5–7: *petiole* 3–7 × 1.5 mm., short: stipules 3–6 mm. long.

Receptacles cauline on short, stout, woody twigs up to 5 cm. long, hanging, subglobose, up to 12 cm. diameter, with a peduncle 2–3.5 cm. long, *closely and shortly villous,* (evidently slightly papillate but not mottled), *peach-red* on the exposed side, peach-yellow on the shaded side: *internal bristles* up to 1.5 mm. long, forming a chaffy layer round the bases of the flowers.

Male flowers: (immature) 8–9 mm. long overall: *perianth* 1–1.5 mm. long, gamophyllous to the middle with 3, rarely 2, lobes: *stamen* 2–2.5 mm. long (immature), rarely 2: *anther* 1 mm. long, exsert.

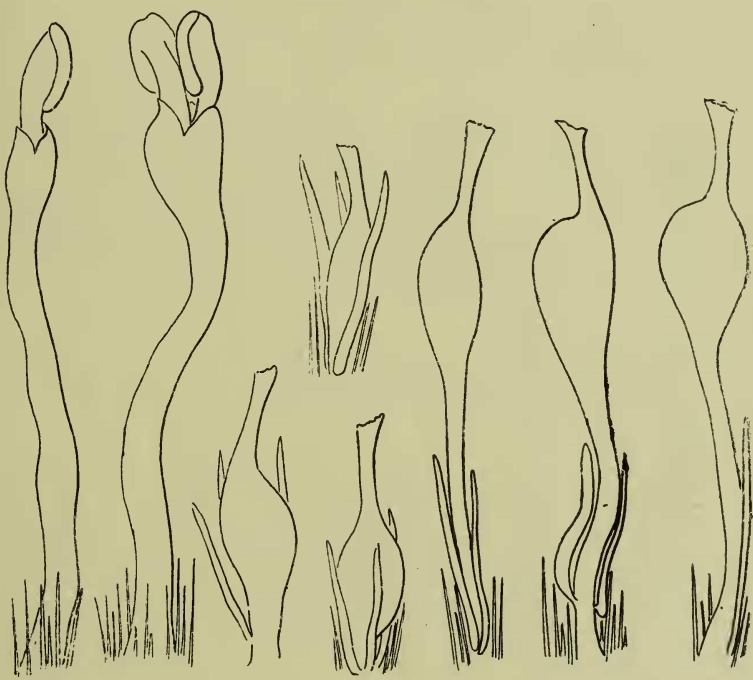
Gall-flowers: (immature) 3.5–7.5 mm. long overall, sessile or with a very short stalk up to .5 mm. long: *perianth* of 1–3, generally 3, linear entire, subgelatinous, free, wine-red segments, simply attached, 2–3 mm. long: *ovary* subsessile or with a stalk up to 4 mm. long: *style* 1.3–1.4 mm. long with denticulate stigma.

Female and neuter flowers and seeds unknown.

Distr. Brit. N. Borneo.

Collections:—

Elmer 20531, pr. Tawao (type).



Text-Fig. 27 *F. tawaensis:* gall- and male flowers (immature), from the type-collection: × 10.

This species is known only from the type-collection, of which I have seen the specimens in Manila, Buitenzorg and Singapore. It is a true Synœcia with receptacles like *F. punctata* but the leaves are very unlike Synœcia-leaves in being regularly and deeply cordate, persistently villous on

the underside and without stomatal pits: they suggest, in fact, a Eusyce as *F. pumila*. The woody fruiting tubercles which Merrill remarked as distinctive and like those of Covellia are no different from those of old, massive plants of *F. punctata* or *F. callicapra*. The receptacles, if really 12 cm. wide and subglobose, must be the largest figs that have yet been found in the genus. The receptacles, however, are imperfectly known, the preserved specimens being too fragmentary to discover any details. The flowers are in no way distinctive.

I believe that *F. tawaensis* has the habit of *F. punctata* and that it has bathyphylls. The type-sheet in Manila consists of acrophylls but the duplicate at Buitenzorg seems to be entirely bathyphyll-shoots except for one detached acrophyll. These bathyphyll-shoots are lax with long internodes and are rooted at the nodes like the typical bathyphyll-shoots of *F. callicarpa*: the leaves are smaller than the acrophylls of the type-sheet, more oblong and with an almost rounded-hastate base suggesting a 'Convolvulus-leaf': they are symmetric and it is possible that they are the leaves intermediate between bathyphylls and acrophylls.

Koorders 23780 (Tangkil, Paserœan, Java), determined as *F. punctata* var., is a sterile collection of bathyphylls remarkably like those of *F. tawaensis* but I hesitate to identify it without further evidence. It may be the young stage of a climbing Eusyce.

F. trachycoma Miq.

Fl. Ind. Bat. I. pt. II, *1859*, p. 304.

? = *F. aurantiaca* Griff. Notulæ pt. 4, *1854*, p. 394.

Icon. t. 555 fig. II.

Text Fig. 32.

Blade 4–10.5 × 2.5–6.5 cm., *ovate elliptic,* slightly or distinctly inequilateral, stiffly coriaceous, *narrowed gradually to the subacute or acute tip,* in some cases apiculate, *the upperside more or less harshly scabrid* with short, white stiff forward pointing hairs with swollen bases, *or scabrid only in the distal half* or weathering smooth, *underside similarly wholly scabrid and with minute hairy stomatal pits in the areolae: edge* entire or very minutely toothed, often slightly incurved: *primary lateral veins 7–10 pairs, arising at a wide angle of 65–70° from the midrib,* inarching at a distance of 2–3 mm. from the edge, hardly visible on the upperside of dried leaves, very slightly raised below, fine: secondary veins faint, irregular: *base rather broadly rounded, subcordate,* slightly but distinctly or scarcely asymmetric, with 3 nerves: *petioles* .5–1.5 × .2 cm, *short,* thick glabrous: *stipules* 8–15 mm. lanceolate, finely hairy to glabrescent.

Receptacles rather large, *axillary on the leafy twigs, scabrous,* umbonate when young, ripening orange-red (apparently with ovoid cylindric body, rather long neck and very short peduncle).

Flowers?

Distrib. Java, (Tjibodas, Mt. Salak).

Collections:—Herb. Horb. Bot. Bog. 7220, cult. Buitenzorg. v. Steenis 2698, G. Tjibodas ± 275 m.

This is a rare species, evidently allied closely with *F. callicarpa,* and one of which there are no recent collections with receptacles. Its distinguishing characters are the rather broad, pointed, scabrid leaves with rounded base and many pairs of side-veins and the scabrid axillary receptacles. Neither the flowers, nor the bathyphylls nor any details of the receptacles are known. It may well be a variety of *F. callicarpa.* From *F. cataupi,* which also has scabrid leaves, it differs in the broader blade with more numerous, fine lateral veins.

I have avoided reference to King's description of *F. aurantiaca* Griffith because I believe that it is a mixture. I have not seen Griffith's specimen but his description and figure suggest the young stage of *F. callicarpa,* which may have axillary receptacles. Griffith's habitat is "on trees, Malacca". I have collected in Malacca several times in the last few years and found only *F. callicarpa typica, F. callicarpa crassinervia* and *F. apiocarpa* as species of Synœcia, the first being very common on coconuts and durians in all the villages, so that Griffith could hardly have missed it. On the other hand, specimens agreeing with the Javanese *F. trachycoma* have never been seen in Malaya in the last eighty years. I think that King mistakenly identified Griffith's plant with the Javanese and thus gave a mixed description with floral characters taken from Griffith's plate. The leaves drawn by Griffith are just like those of *F. callicarpa* which are transitional between bathyphylls and acrophylls and shoots bearing such leaves may develop precocious, axillary receptacles. The undersides of the leaves of *F. callicarpa,* moreover, are "tactu aspera verruculis plurimis albis", as Griffith described, because of the slightly raised margins of the stomatal pits. Burkill's record of *F. aurantiaca* (S.F. No. 6429) is *F. callicarpa.*

If *F. aurantiaca* Griffith is *F. callicarpa* Miq. it is an earlier name but it is also a later homonym of *F. aurantiaca* Noronha (4) and *F. aurantiaca* Hort. Berol. (4). (Griffith spelt the name *F. aurantiaceus*). Hence I conclude that Griffith's name disappears from taxonomy and in its place stands *F. callicarpa* Miq. and *F. trachycoma* Miq. which may be a variety of the former.

The collection, v. Steenis 2698, identified as "*F. punctata*" has smaller, more asymmetric leaves than Herb. Hort. Bot. Bog. 7220, which seems to be typical *F. trachycoma*, and I suspect they are bathyphylls, or intermediate between such and acrophylls. Both kinds are shown in Text-Fig. 32.

F. tulipifera nov. sp.

Text-Figs. 28, 29, 35.

F. callicarpae similis: *lamina* 3.4–6.8 × 1.2–3 cm., *elliptico-lanceolata*, medio latissima, *utrinque attenuata*, paullum inæqualis, vel curvata, subcoriacea, *apice acuta*, haud retusa, basi interdum minute cordata vel inæqualis, *margine apicem versus minute denticulata, costis lateralibus* utrinsecus 8–11, subtus prominentibus, costis basalibus 3, *areolis profunde piloso-foveolata:* petiolus 2–9 mm. longus. *Receptaculum cauliflorum, parvum, depresso-globosum,* 3.5 cm. latum, sparse pilosum, *maculis pallidis marmoratum: flores cecidiophori perianthii segmentis saepe 2–3 connexis vel omnino breviter connexis*, haud peltato-affixis.

Distr. Brit. N. Borneo.

Typus. Sing. F. No. 27763, leg C. E. Carr, Mt. Kinabalu.

A climber like *F. callicarpa*, the stems slender 5 mm. thick, (? full-grown): bathyphylls?

The young twigs, petioles and edges and undersides of the leaves rather closely hairy with lax white spreading hairs up to 1.5 mm. long, the mature parts, especially the undersides of the leaves, glabrescent: uppersides of the leaves and *stipules glabrous.*

Leaf-blade 3.4–6.8 × 1.2–3 cm., *elliptic lanceolate,* broadest at the middle, *tapered gradually to each end, generally slightly asymmetric and falcate, the apex acute,* narrow but not acuminate, *not retuse*, the base attenuate, very narrowly cordate, often slightly asymmetric but never auricled, *the edge very finely denticulate*, especially towards the apex, subcoriaceous, not scabrid, bright dark green above, pale green with dark green reticulations beneath, drying rather undulate with the midrib and main veins sunk on the upperside, pale greyish brownish or greyish yellowish above and pale brownish beneath and minutely brown-dotted: *primary lateral veins* 8–11 pairs, *arising at a very wide angle from the midrib and passing almost straight out to the margin*, connected by a conspicuous arching marginal vein ca. 1 mm. from the edge, drying conspicuous, thick and pale brown: *secondary veins* arising from the midrib between the primaries and often almost as conspicuous: *tertiary veins* reticulate, very faint, *enclosing conspicuous deep hairy stomatal pits: basal veins* 3, the

lateral veins continued as the conspicuous marginal veins: *petiole* 2–9 × 1 mm., brown, becoming scurfy-flaky: *stipules* 4–14 mm. long, conical, fairly persistent, glabrous even when young.

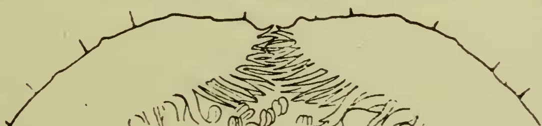
Receptacles on short, woody, bracteate tubercles on the main creeping stem, solitary: *body* 3 cm. long, 3.5 cm. wide, depressed globose, the distal end flattened, not umbonate, pimply with small lenticels, *sparsely pilose with erect, hispid, white hairs* up to 1 mm. long, olive green with paler, cream mottling (unripe): *neck* 8 × 4 mm., distinct: *peduncle* 0: *basal bracts* 3, triangular, acute, scarcely spreading, glabrous, 2–3 mm. long: *orifice* 2 mm. wide, circular, slightly depressed and surrounded by a faint, narrow, raised rim, closed by 3 apical bracts slightly raised into a low cone: *internal bristles scarce, very inconspicuous,* up to 1 mm. long.

Male flowers 9–13 mm. long overall; stalk white, much curved: *perianth* 2 mm. long, wine-red, gamophyllous to the middle, with 3, in some cases 4, rarely 5, blunt lobes: *stamens* rarely 2, immature, the anther 1.5 mm. long and half-exsert.

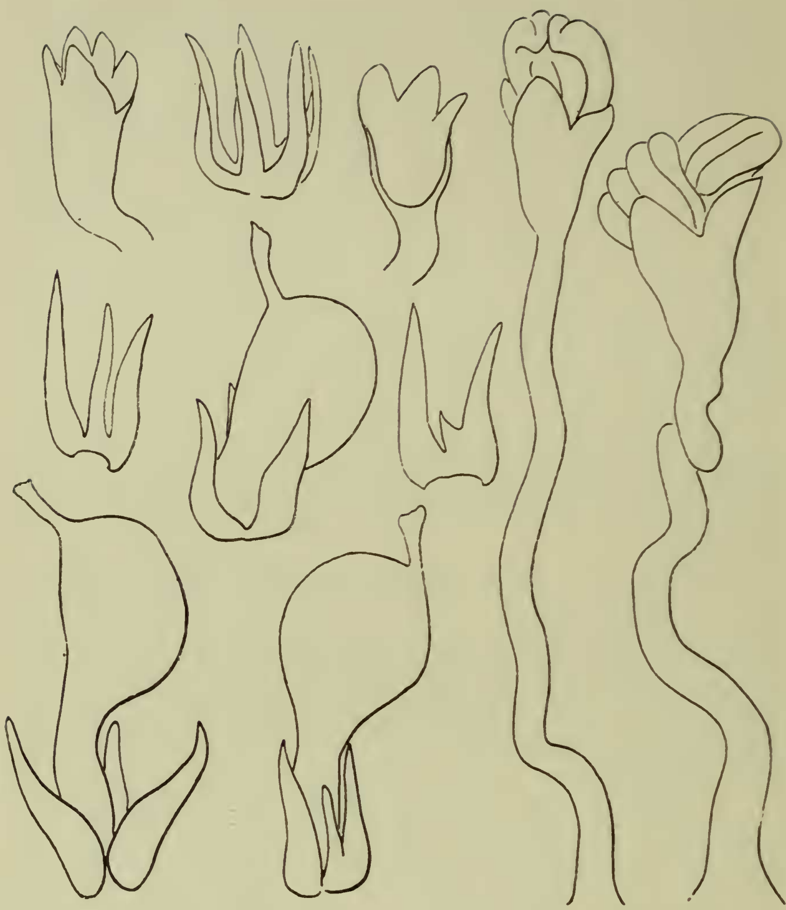
Gall-flowers 3–5.5 mm. long overall, sessile: *perianth* of 3–4, occasionally 5, lanceolate, entire, subgelatinous, wine-red segments 2–2.8 mm. long, strongly thickened at the base, 2–3 often shortly gamophyllous at the base, in some cases appearing as if there were 1–2 free segments and one deeply 2–3–fid segment, with simple transverse linear attachment: *ovary* with a short or rather long stalk: *style* ca. 1 mm. long.

I describe this species from dried twigs and an apparently full-grown but immature receptacle attached to a leafy twig in spirit. The emergence of the stamen shows that the fig, which is unusually small for Synœcia, must be almost or quite full-grown. The specific epithet refers to the appearance of the male perianth.

The species comes very close to *F. callicarpa* but the perianth of the gall-flower, the acute apex of the leaf, its denticulate edge and the many primary lateral veins prevent one from making it a variety of that species. It is also close to *F. cataupi* which has fewer primary lateral veins and scabrid leaves as well as the perianth of *F. callicarpa.* (But see the remarks under *F. callicarpa*).



Text-Fig. 28 *F. tulipifera:* section through the orifice of a gall- receptacle of the type-collection: × 2.



Text-Fig. 29 *F. tulipifera:* mature gall-flowers and their perianths, and 2 mature male-flowers with 2 cut-open perianths (upper middle and left) from the type-collection: × 10.

Summary

Thirteen species and four varieties are described, the following as new:—*F. barba-jovis, F. Carri, F. dens-echini, F. grandiflora, F. tulipifera, F. callicarpa* var. *parvifolia*, var. *crassinervia*, var. *angustifolia*, var. *multinervia*.

F. megacarpa is reduced to *F. callicarpa* as var. *parvifolia*. *F. trachycoma* is raised to specific rank. F.

aurantiaca, F. Simiae and *F. singalana* are doubtful species. The Philippine specimens referred to *F. apiocarpa* are *F. Scratchleyana. F. antoniana, F. areolata, F. brunnea, F. Warburgii,* referred to Synœcia, are Eusyce. *F. Johnsoni,* referred to Synœcia, is Urostigma. *F. callicarpa* is hardly to be distinguished specifically from *F. punctata.*

Synœcia is a natural subgenus of closely allied root-climbers, the more advanced species being among the most highly specialised developments of Ficus. It is important to recognise *a.* the distinction between bathyphylls (leaves on creeping stems) and acrophylls (leaves on the free-hanging, subærial stems). *b.* the presence or absence of stomatal pits on the underside of the leaves. *c.* the position, the colour and the structure of the orifice of the receptacles.

A natural and artificial classification of the species is given.

Synœcia is limited to Malaysia with Burma, ? Indo-China, Formosa, New Guinea, Timor, Java, and Sumatra as its limits. Its greatest development is in Borneo whence it seems to have spread. The five new species were all found in N. Borneo.

It seems that animals do not eat the large, brightly coloured receptacles, so that species of Synœcia are without special means of dispersal.

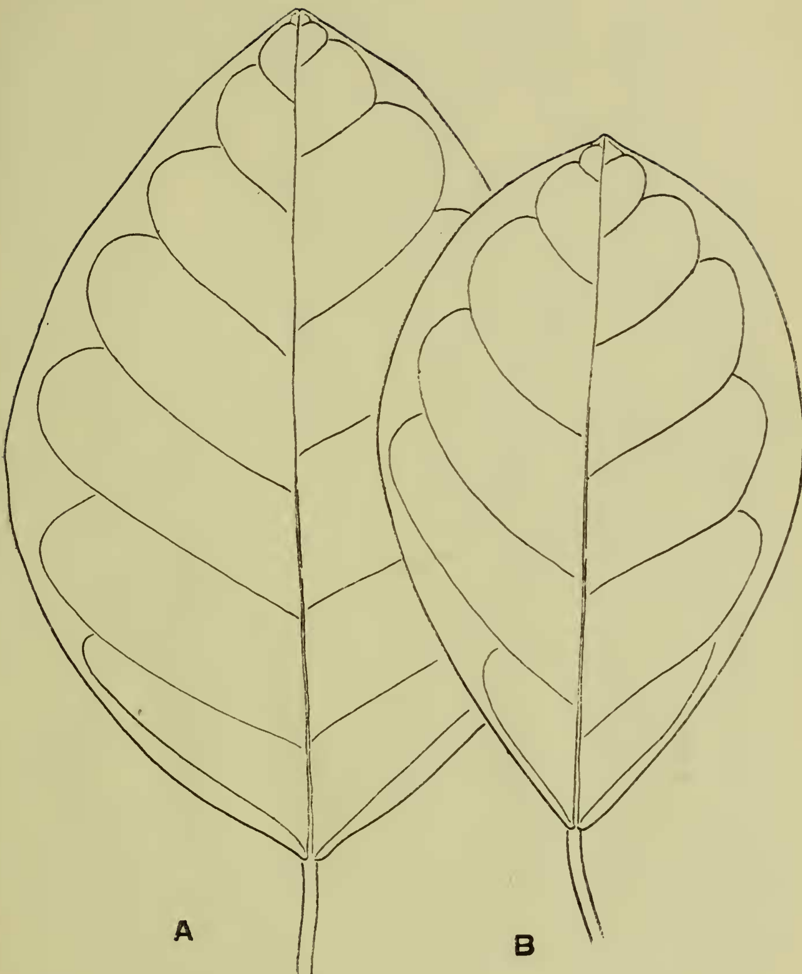
Drawings are given of the flowers and leaves of all species and, in many cases, of the orifice of the receptacle.

References

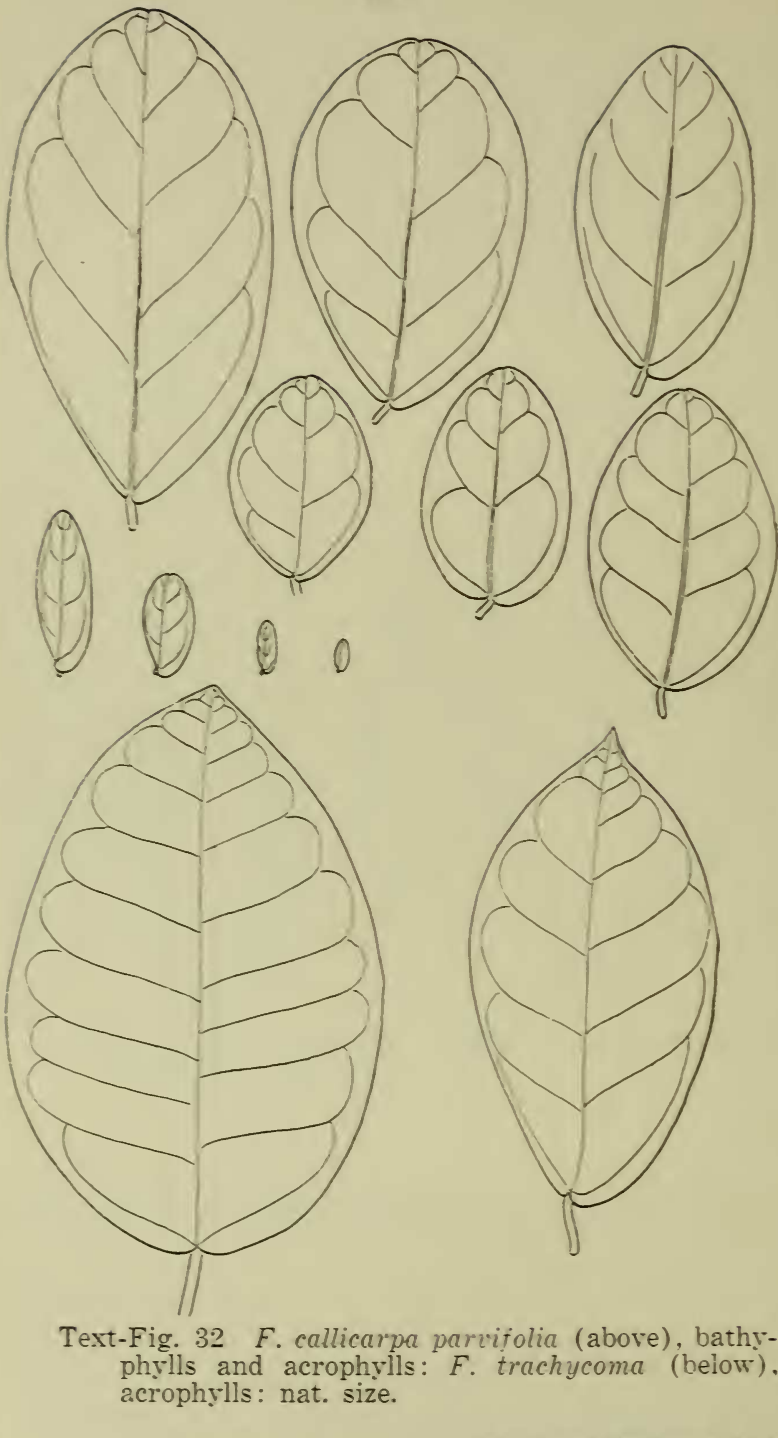
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Text-Fig. 30 *F. callicarpa* typical: bathyphylls and acrophylls: nat. size.



Text-Fig. 31 *F. callicarpa* typical: **a**, Lorzing 7258; **b**, Wray 2022: nat. size.



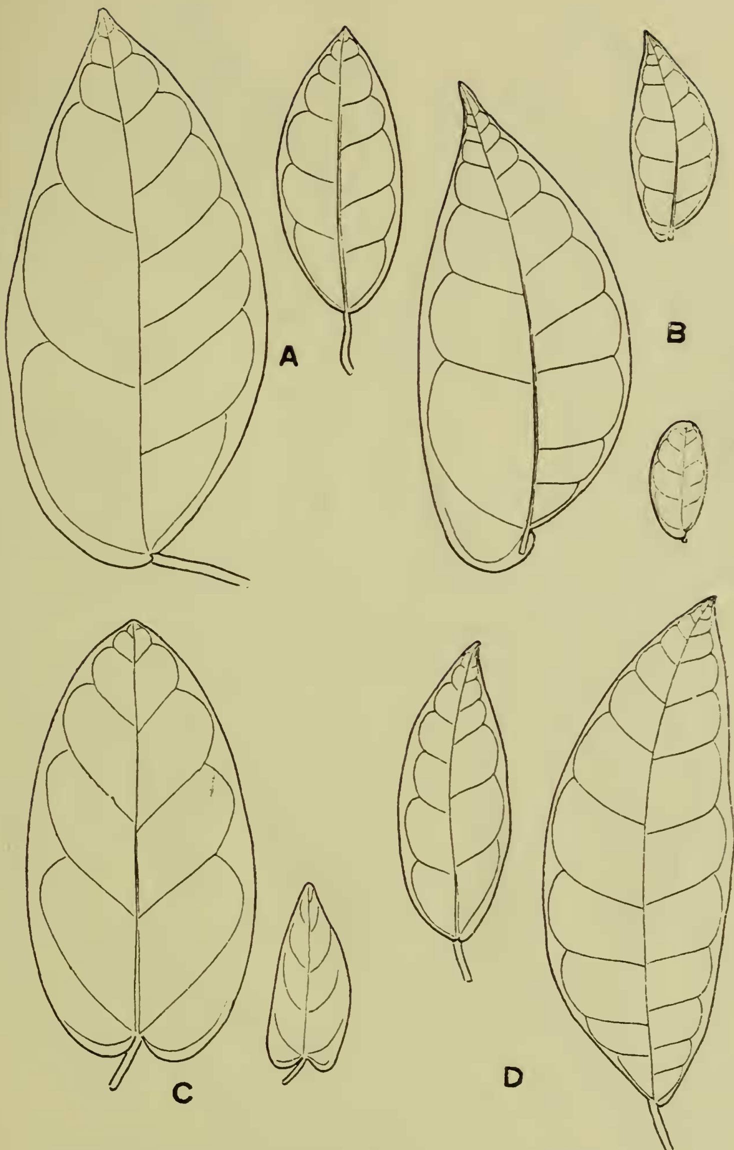
Text-Fig. 32 *F. callicarpa parvifolia* (above), bathyphylls and acrophylls: *F. trachycoma* (below), acrophylls: nat. size.



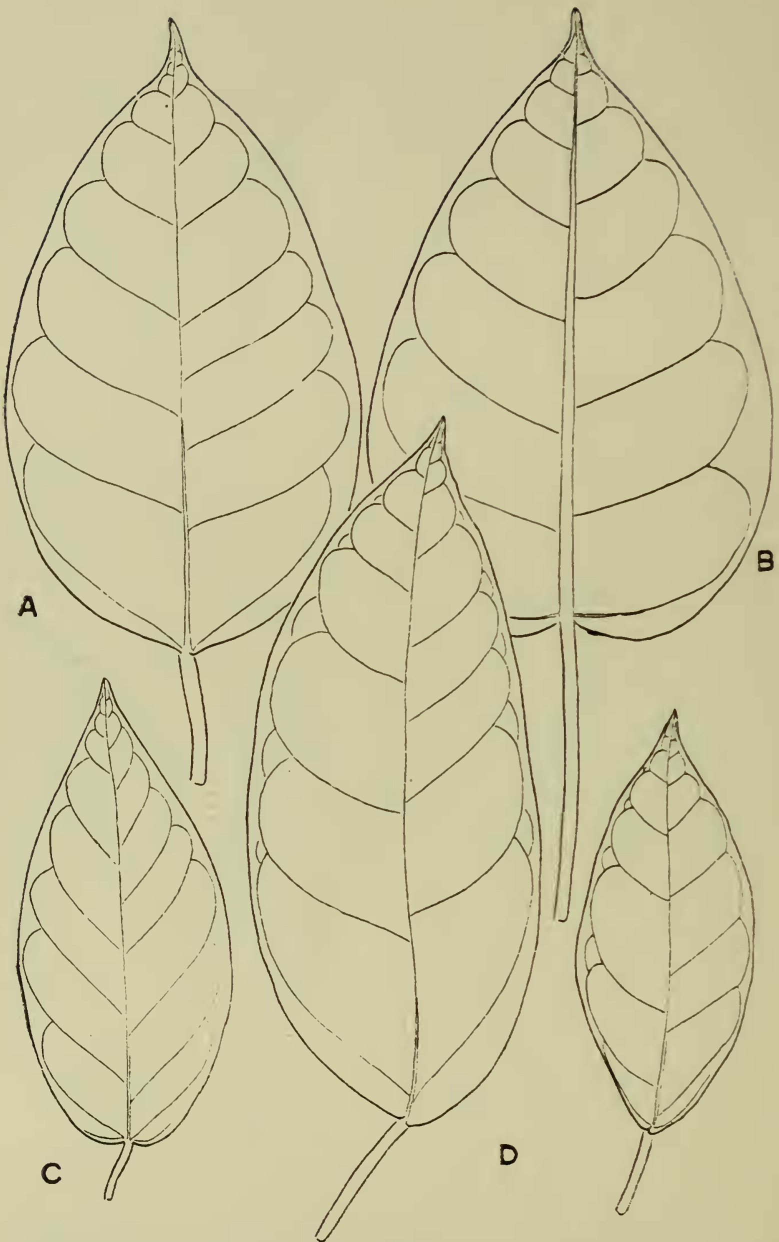
Text-Fig. 33 *F. callicarpa angustifolia* (above) acrophylls: *F. callicarpa crassinervia* (middle), bathyphylls and acrophylls: *F. punctata* (below) bathyphylls and acrophylls: nat. size.



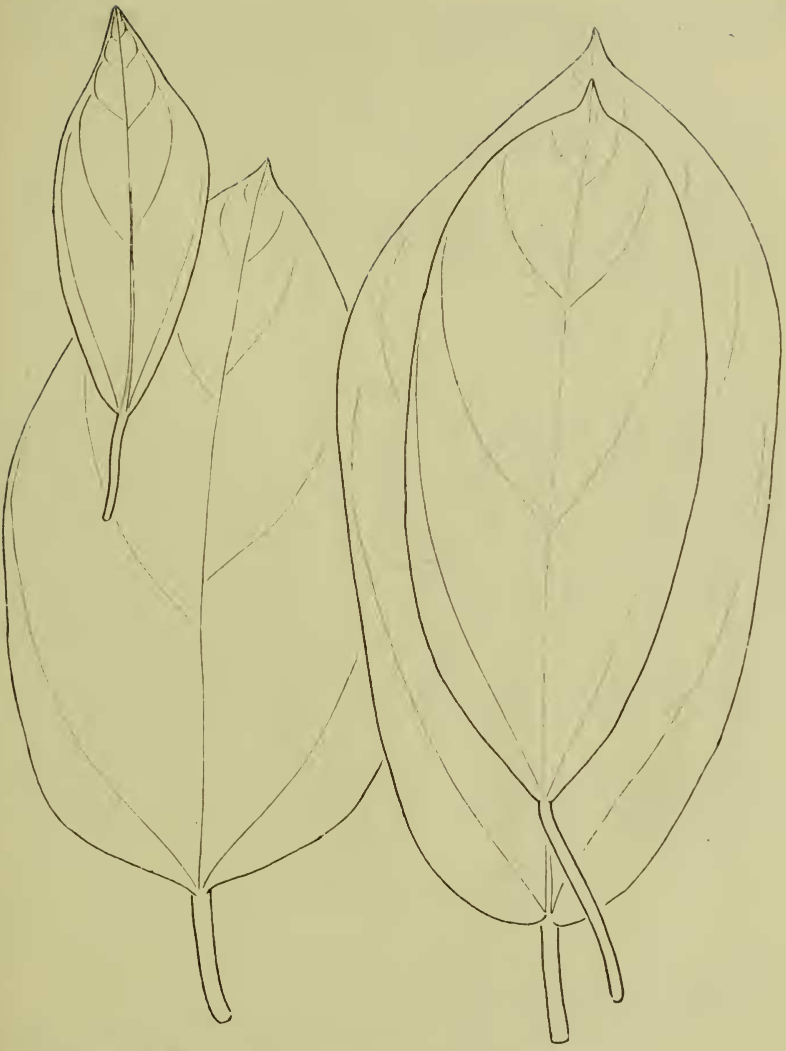
Text-Fig. 34 *F. callicarpa multinervia,* acrophylls: nat. size.



Text-Fig. 35 *F. cataupi*, **a**, 2 leaves: *F. barba-jovis*, **b**, 3 leaves: *F. tawaensis*, **c**, 2 leaves: *F. tulipifera*, **d**, 2 leaves: nat size.



Text-Fig. 36 *F. Scratchleyana*, **a**, (Philippine) : *F. dens-echini*, **b**: *F. Bordenii*, **c**: *F. Carri*, **d**, 2 leaves: ½ nat. size.



Text-Fig. 37 *F. apiocarpa*, ½ nat. size.